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LOCKE'S SOLUTION AND THE CORNEA

BY

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FOR the past two years I have been experimenting with a solution which as far as I know has hitherto not been used in ophthalmology. The solution contains the mineral salts of the blood with the addition of dextrose and is known as Locke's solution. The solution is used a great deal in physiological experiments. The following is the complete formula:

Sodium Chloride	0.9
Sodium Bicarbonate	0.05
Potassium Chloride	0.042
Dextrose	0.1
Calcium Chloride	0.025

Distilled water sufficient to make 100.

I have found the solution of great value in the treatment of corneal diseases, more especially in cases of corneal traumatism.

I first tried the solution two years ago on a boy admitted to the Birmingham Eye Hospital. The boy was removing a nib from a steel penholder, when the nib suddenly parting from the holder caused the boy to strike the right eye with the holder itself.

On examination it was found that a strip 3 mm. wide and about 5 mm. long had been gouged from the central part of

the cornea. At its deepest part the wound penetrated half the thickness of the cornea. The strip was adherent at one end by a slender filament of epithelium. At first sight the only feasible procedure to adopt was to sever the slender filament and remove the strip completely, allowing the furrow in the cornea to fill up with granulation tissue. This, of course, would have caused a large amount of irregular astigmatism and also a dense scar.

It then occurred to me that a solution containing the elements of lymph, if applied frequently to the cornea, might maintain the vitality of the excised strip and allow it to reunite. The strip of cornea was placed in position and Locke's solution applied hourly during the day, a light pressure bandage being applied during the intervals. In a week's time the strip had re-united and only a very slight opacity was present at the interfaces, the strip of cornea itself being perfectly clear.

The Locke's solution was used double strength and was oxygenated by passing in oxygen gas from a cylinder. The solution was used double strength in order to combat the dilution effect of the lacrymal fluid. No other treatment except the Locke's solution was employed.

Recently I have had such remarkable results with corneal abrasions that I thought it justifiable to record some of the cases. A young lady was struck in the right eye with a tennis ball. Her vision was reduced to less than 6/60. Almost the whole of the cornea stained deeply with fluorescein and with the slit-lamp it was found that the epithelium was denuded from almost the whole of the staining surface, small shreds of epithelium only being adherent here and there. A few pigment cells were visible floating in the aqueous humour. The fundus was apparently normal, but could not be focussed sharply owing to the irregularity caused by the abrasion.

Locke's solution, double strength, but without oxygen, was instilled two-hourly. In seven days' time the cornea was entirely covered with epithelium, there was no staining with fluorescein, and vision was 6/6.

A man, aged 50 years, attended St. Paul's Eye Hospital, Liverpool, complaining of great pain in the right eye. He had been struck in the eye with a tennis ball the day previously. His vision could not be taken as the eye was blind owing to an accident thirty years ago. On examination it was found that the cornea stained deeply with fluorescein over a large part of its surface. A 5 per cent. silver proteinate salt with 1 per cent atropine was ordered and a light pressure bandage applied. In a week's time there was no improvement, and quinine was substituted for the silver salt and used for a further period of four days. The cornea showed no signs of regenerating its epithelium and the patient was suffering

from much pain. Double strength Locke's solution was then ordered and in three days' time the patient reported at the hospital when it was found that the cornea was almost completely covered with epithelium and only stained in one small area. I have also treated with satisfactory results indolent corneal ulcers.

As the cornea depends for its nourishment on the lymphatic supply I think it quite reasonable to assume that a solution having a similar composition to lymph, as far as the mineral salts are concerned at any rate, will have a beneficial action when applied frequently to the cornea. The beneficial action being to hasten the reparative processes will chiefly manifest itself in the superficial layers of the cornea.

RETROBULBAR NEURITIS ASSOCIATED WITH SINUSITIS, OPERATION, RECOVERY

BY

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FEMALE, aged 21 years (E.H.) was seen August 11, 1926. Patient complained of right eye being blind for one month. The patient said that a month ago she had pain on moving the eyeball. This commenced suddenly and was also associated with an acute nasal catarrh, and the condition lasted three weeks. During this time she had difficulty in looking inwards. Her grandfather became blind at the age of 38 years. On examination :—without lenses : V.O.D. fingers at two metres; without lenses : V.O.S. 6/10. With lenses : V.O.D. 6/60; with lenses V.O.S. 6/10.

A central and paracentral scotoma was discovered on the Bjerrum screen for red, green, and blue.

The edge of the optic disc was hazy on nasal side and the nasal blood-vessels near the disc were indistinct. The left optic disc and fundus were perfectly clear. Examination of the nose showed a deviation of the septum to the right in the region of the middle turbinate, but no sign of hypertrophy or oedema of the mucous membrane was present. No pus was seen and the frontal and maxillary sinuses were clear on transillumination. On account of the central scotoma, history of involvement of the muscles which lie to the inner wall of the orbit, and the history of acute nasal catarrh (although the latter did not occupy a prominent place in her mind) operation was offered. The patient accepted operation and, on August 13, I removed the middle turbinate and opened the sphenoid and posterior ethmoid cells (with Sluder's

knife). In order to gain space for the operative procedures I first did a sub-mucous resection of the septum. The operation was performed under morphia and scopolamine with local applications of cocaine paste.

At the operation no sign of pus or secretion was seen. The walls of the ethmoid cells and sphenoid sinuses were thin.

After-history: August 13 operation, August 19 nasal condition good. V.O.D. without lenses 6/15 - 4 (*i.e.*, saw two letters out of six on 6/15 line), central scotoma for green, but the red and blue scotoma was no longer present. The appearance of disc was the same as on August 11.

August 26: V.O.D. = 6/15 - 3. Upper and lower nasal edge of disc not distinct, pink in colour. Lower temporal edge distinct and white. Scotoma for colours no longer present.

September 4: Cloudiness on nasal side of disc disappeared, outline of blood-vessels quite clear, edge of disc more distinct.

September 16: V.O.D. = 6/10 - 2; V.O.S. 6/10. Edge of disc clearly defined except that the demarcation between disc and fundus at upper and nasal side not clear, but as the disc on the opposite side presented the same appearance, the patient was discharged as cured. The disease existed one month before the operation and cleared up one month after the operation.

During the last two weeks of after-treatment Hyd. c. cret. 4 grs. with pot. iod. 20 grs. was daily administered (*i.e.*, two weeks after operation), but before any drugs were administered the vision had improved from fingers at two metres to 6/15 - 4 and the colour scotoma had disappeared.

KRUKENBERG'S SPINDLE IN A CATARACT CASE

BY

R. R. JAMES

LONDON

I HAD never seen or heard of a case of Krukenberg's spindle before reading the proofs of Dr. Cardell's paper in the *Brit. Jl. of Ophthal.* in the April number, Vol. X, p. 198. The following case seems worthy to be recorded briefly:

A.F., a single woman, aged 63 years, attended my out-patients' department at St. George's Hospital, on April 17, 1926, with a mature cataract in her only useful eye. The history, traced from the hospital records, was as follows: She first attended in June, 1889, under the care of Mr. Adams Frost; the notes of this first visit are rather fragmentary, but the vision with pupils dilated

with homatropine and cocaine was noted as follows: R.E. -6.0 sph. = 6/24; L.E. -14.0 sph. = 6/60. In 1894, a better result was recorded; R.E. -10.0 sph. = 5/12; L.E. -14.0 sph. = 5/60. In 1897, the visual result was the same.

In 1898, she attended complaining of visual failure in the left eye, preceded by black spots of three weeks' duration. A shallow retinal detachment was discovered downwards and inwards, the area of detachment being limited by a patch of old choroidal atrophy. She was admitted and underwent the usual treatment of rest in bed with diaphoresis, and the subretinal fluid was tapped by Mr. Frost. She was discharged at the end of the year and on December 30 the condition was noted as unchanged. The next note of her attendance was in January, 1911, when I saw her myself and noted that the best visual result was 6/18 in the right eye with -14.0 sph, -2.0 cyl. axis horizontal. The left eye was divergent and blind with an opaque lens.

She returned in April of last year with a mature cataract in the right eye, which, from the history, had been of rather rapid development for she had been able to pursue her avocation as a cook up to the beginning of this year.

The vision was less than 6/60; projection of light was good. Many years ago I learnt from Mr. William Lang the importance of examining my cataract cases prior to operation, without and *with* a mydriatic; and so I instilled homatropine and cocaine, and when the pupil was well and evenly dilated I examined the cornea in order to exclude keratic precipitates. I was astonished to find an oval pigmented patch situated vertically in the cornea, and slightly towards the nasal side of the centre; this was composed of fine brown dots which with the loupe appeared to be situated deeply in the cornea. The appearance was almost exactly similar to the peppery deposit on the anterior capsule of the lens seen in some cases of persistent pupillary membrane; but the pupil was evenly dilated, no tags were present, and, moreover, the patch was in the cornea. It showed particularly well against the white background of the opaque lens. I diagnosed a Krukenberg's spindle and as I was due to leave town almost immediately for my holiday, advised the patient to come in for extraction on my return. This she did, and early in August I removed her cataract, performing an iridectomy before removing the lens. I did the iridectomy first instead of at the end of the extraction, which is my usual practice, because of the history of retinal detachment in the other eye; knowing that if vitreous escaped from a ruptured hyaloid and the lens sank back into the vitreous, the extraction of it with a vectis would be thereby facilitated.

The extraction was uneventful, except for the fact that the fixation forceps wounded a small subconjunctival vessel and the

patient got the largest subconjunctival haematoma I have ever seen: at the end of the operation it stood up round the lower and inner part of the cornea, looking very much like a kidney with the hilum at the limbus. Before bandaging the eye I tapped this haematoma with a cut from a pair of scissors. Recovery was uneventful and the case left hospital at the end of the month.

Tested in out-patients' department on September 1, 1926, the visual result was: R.E. +0.75 cyl. axis horizontal = 6/9. There was a large myopic crescent, the macula was healthy as was the vitreous, and the spindle was very obvious; it could be seen with focal illumination by the naked eye. I could not discover any trace of a spindle in the blind eye.

Seen by the aid of the slit-lamp the change in the cornea appears to be more diffuse than one would be led to expect by simple examination with the loupe; to the latter the appearance was really that of a spindle more or less in the centre of the cornea.

The picture by Theodore Hamblin, Ltd., with the aid of the slit-lamp, shows the condition excellently. I am indebted to Mr. Duke-Elder for the trouble he took in attending with the patient and showing the draughtsman exactly what was wanted.

TREATMENT OF TRACHOMA BY ACETIC ACID

BY

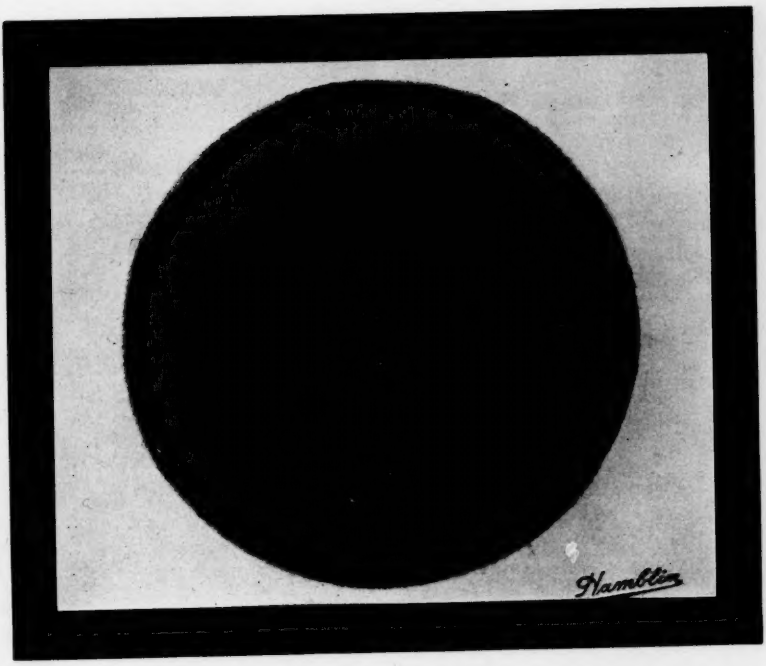
J. A. LEA

NATAL

HAVING seen lately in the BRITISH JOURNAL OF OPHTHALMOLOGY several papers, more especially abstracts from foreign sources on the treatment of trachoma, and having noticed how varied the treatment was, and in some instances severe, I am encouraged to give my experience of a plan of treatment which I have found successful during the time that I have practised as an ophthalmic surgeon in South Africa.

When first I came to South Africa several years ago I found trachoma very prevalent, more especially in the dry, dusty up-country districts; and had many severe and neglected cases to attend. I used the usual remedies with only moderate success. I then commenced this plan of treatment which I followed with success until I retired from practice a few years ago.

My method of procedure is as follows: I wash the eye and eyelids with a saturated solution of boracic acid. I then drop in a 0.5 per cent. solution of cocaine (I use Darier's solution which contains also adrenaline). I then take an instrument made for



KRUKENBERG'S SPINDLE.

me by Messrs. Weiss (an ordinary tattooing needle will do), dip it into a mixture of equal parts of acetic acid and water taking care to fill the groove, and having everted the eyelid, prick every true granulation and also very thoroughly any wavy rolls, or fringes of conjunctiva; wash again with a solution of boracic acid; and apply a cold compress to the eyelids for an hour or so.

This can be repeated two or even three times a week, and when the true granulations have disappeared I apply sulphate of copper to the hypertrophied papillae, alternating this with a 2 per cent. solution of nitrate of silver; more especially if the sulphate of copper causes too much irritation.

I have been astonished at the rapidity with which the true granulations, and wavy appearance of the conjunctiva disappeared after pricking with the acetic acid.

It is easy to do, as the true granulations are soft, the needle sinks in by its own weight, and consequently the operation is practically painless if carefully done.

It is useless as an application to the false granulations for which sulphate of copper seems to be a specific. I like to use a fine-pointed stick of sulphate of copper, and apply carefully to the granulations washing off any excess with a solution of boracic acid.

I have noticed in reading papers on the subject of trachoma that there is not only a want of unanimity in the methods of treatment, but there is also some want of agreement as to what constitutes a case of trachoma. I will therefore describe the kind of case seen in South Africa.

On everting the eyelids a velvety red surface interspersed with grey translucent dots is seen: these dots vary in size from that of a pin's head to that of a hemp seed; and in some cases in the fornices there are rolls of wavy-looking tissue; there is frequently some amount of pannus, and sometimes a facetted ulcer, or ulcers on the cornea. The amount of discomfort is usually less than one would expect from the appearance of the eye; and the ulcers have little tendency to break down or slough. These true granulations are soft, as are also the wavy masses, differing from the hypertrophied papillae which are firm, and the granulations of spring catarrh which are very hard. One often sees scar tissue on the conjunctival surface of the eyelid in old cases with bluish congested patches, and white lines.

I should like to relate a case which shows how long a case of trachoma may last, and that the lymphoid bodies may be concealed under the thickened conjunctiva. A Polish Jew, aged about 30 years, had suffered from his eyes from the time of his arrival in this country when aged about 12 years. He had had frequent attacks of inflammation of the eyes relieved by treatment

but never entirely cured. When I first saw him: on everting his upper eyelids I found the conjunctiva bluish and congested in patches with white lines of cicatrices, and no granulations. In the fornices were rolls of wavy semi-translucent looking conjunctiva; in the right eye there was a small facetted ulcer of the cornea with a clear surface, and some amount of pannus. I applied the acetic acid treatment to the wavy-looking conjunctiva, and followed it with applications of solution of nitrate of silver, 2 per cent., once every week. After several applications he appeared to be cured and I lost sight of him for a few months. He appeared again one day with acute inflammation of the right eye: on everting the eyelid I found a linear swelling extending along almost the whole length of the eyelid. Expecting to find pus I incised the swelling, and uncovered four lymphoid bodies about the size of hemp seeds, which I removed.

I saw this man several times afterwards at long intervals, and found that his eyes gave him no more trouble except a little irritation on windy dusty days which might be expected from the dry cicatricial condition of his conjunctiva.

BARRAQUER'S OPERATION

BY

J. RUSSELL SMITH, M.R.C.S.

LONDON

"I do not believe in violence—especially if it is not likely to be successful."

I AM indebted for this quotation to my father, Lt.-Col. H. Smith, C.I.E., I.M.S.(ret.), whose experience of some 50,000 cataract operations performed during his time as Civil Surgeon of Jallandar and Amritsar, Central Punjab, has been of the greatest assistance to me in writing this article. The quotation is taken from the first edition of the "Collected Public Addresses of Gandhi," whose policy was to "spiritualize" Indian politics in order to bring them into harmony with the Holy Writ of Hinduism.

Professor Barraquer's article in Dr. W. A. Fisher's book on "Senile Cataract," in the edition published in 1923, by the Chicago Eye, Ear, Nose, and Throat College (obtainable from Messrs. H. K. Lewis & Co.), is a mine of information which well repays careful study. He seems to have evolved a method of dislocating and extracting the cataractous lens in its capsule, which, if the claims he makes for it are correct, constitutes a revolution of the very greatest importance. For to quote from page 38: "Facoerisis

consists in drawing the crystalline lens by its anterior surface, separating it mechanically without either traction or violence of the zonula (suspensory ligament) and extracting it completely out of the eyeball, without having produced ectopias or traumatism to the intraocular structures. The instrument employed, called the Erisifaco, is nothing more than a pneumatic forceps and a zonulatome. Fig. 39 represents a longitudinal section of the Erisifaco and of the intermittent or vibratory pump which is employed to work it." A critical examination of these claims should be of interest to the profession.

The first thing to examine is this vibratory pump on which a very large part of the claims for the method are based. A year

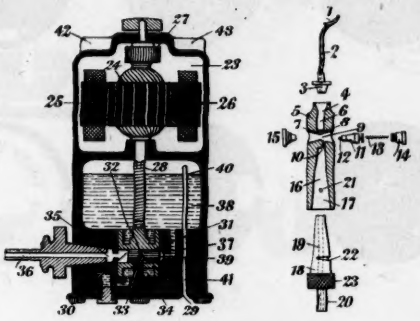


FIG. 1.

Fig. 39 from Barraquer. Section of pump and handpiece (vertical section).

or so ago Professor Barraquer did my father the kindness of presenting him with a complete outfit for facoerisis. Messrs. Down Bros. took the apparatus to pieces for us and examined it minutely. It is an ingenious and exquisitely made piece of machinery. In my description of it the numbers in brackets refer to Professor Barraquer's diagram, Fig. 39, in his article, which I reproduce as Fig. 1.

The pump consists of an inner cylinder (29) which is solid except for a transverse tunnel (30) bored across its lower part at right angles to the vertical axis about which it revolves. In the bottom of this cylinder there is a fairly wide central circular hole which is bored from its under surface into the transverse tunnel. This hole is in line with the shaft attached to the inner revolving cylinder above, on which is fixed the armature of the electric motor which drives the machine. It engages with the pin (33) which projects upwards from the bottom of the case, and the two form part of the bearings of the machine. The outer part of the

pump consists of a cylindrical case, which above contains the magnets of the motor, below is accurately machined on the inside to fit the central revolving cylinder (29). In it are two holes (35 and 37). These are placed diametrically opposite one another in the horizontal plane in which lies the axis of the transverse piston tunnel bored in the inner revolving cylinder (29). Hole 35 is the air inlet to the pump; hole 37 the air outlet. The transverse piston tunnel contains a solid piston, not long enough to fill it, and machined accurately to fit its walls. In the middle of this piston,

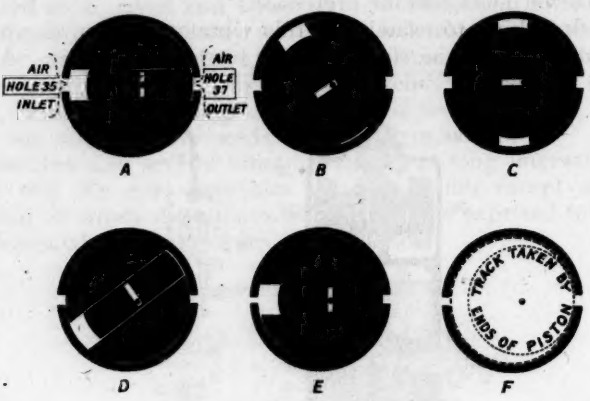


FIG. 2.

Transverse section through pump at various stages in the cycle of operations.

on its under surface, is a transverse slot in which works a small eccentric projection (A) of the pin (33) fixed in the case.

The working of the pump is easily explained by the diagrams in Fig. 2, which represent horizontal sections through holes 35 and 37, and the piston tunnel at successive phases in one revolution of the central cylinder. The small eccentric pin attached to the case is set so that at the starting point (Fig. 2A) when the tunnel is in line with the two holes 25 and 37, the end of the piston which is opposite hole 37 is in contact with the walls of the case; the end opposite hole 35 is furthest away from them. The next three diagrams represent the intermediate stages, the fourth the completion of half a revolution, while in the last the track taken by the ends of the piston is dotted out. It will be seen how they gradually leave the wall of the case as they pass from hole 37 towards hole 35, so producing a space in the tunnel into which the oil cannot get to fill it up as fast as it is formed, for the parts are as accurately machined and fitted together as the engine of a Rolls-Royce motor car. When the tunnel reaches hole 35 air rushes

from the latter into the space to fill up the vacuum which has been formed in it. In the second half of the cycle the piston again approaches the walls of the case, so compressing the air in the tunnel, and expelling it finally through hole 37.

It is thus clear that once in each half revolution air is sucked in from the tubing attached to hole 35, and a sudden alteration is produced in the pressure of that which remains behind—the variation in the intensity of the vacuum, termed by Professor Barraquer its interruption or vibration. The rate at which these variations succeed one another is 5,000 per minute, according to his account

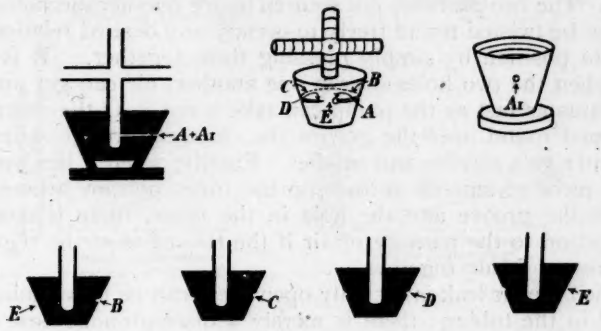


FIG. 3.

Diagram of variable air leak.

on page 98, which involves the pump running at 2,500 r.p.m. The degree to which it is capable of exhausting the air in a closed chamber attached to it is dependent on several factors, the vapour pressure of the oil used being the ultimate theoretical limit. In practice the speed at which it works has some bearing, and varies with the viscosity of the oil used and the voltage of the current applied to the motor. Professor Barraquer supplies oil of relatively high viscosity, but Weiss told me that they found it to be most efficient with the thinnest oil available.

The device, which is used to regulate the intensity of the vacuum and the amplitude of the variations in it, is most ingenious. It is attached in different machines to different parts of the apparatus, and has been altered in detail in successive models, but in all it is in principle the same. It is a variable air leak, Fig. 3, which can be set to let air into the apparatus at any desired rate. In its latest form it consists of two parts, an inner and an outer metal tube whose adjacent surfaces are machined to a conical shape and fit one another accurately. There is a hole drilled through the

inner part which is the only communication between the exterior and the interior of the apparatus except that at the cup of the Erisifaco. This latter is normally sealed by the lens when it is in action or shut off by the valve in the handpiece. On the outer conical surface of the inner tube is a V-shaped groove which starts from the hole and passes round in a circle almost but not quite to the hole again. It gets gradually shallower until it finally fades away into a short piece of smooth surface lying between its own end and the hole. The outer part has also a hole through it, which, when the two are fitted together, overlies the hole in the inner part or some point on the circle in which the groove in it is cut. The two parts are not secured to one another mechanically, but can be twisted round freely to occupy any desired relation and fixed in position by simply pressing them together. It is clear that when the two holes overlie one another, air can get into the apparatus as fast as the pump can take it out. As the outer hole is turned round over the groove the channel through which air can enter gets smaller and smaller. Finally, when it lies over the small piece of smooth surface on the inner portion between the end of the groove and the hole in the latter, there is complete obstruction to the passage of air if the two parts of the regulator are pressed firmly together.

When the air leak is set fully open there can be no vacuum produced in the tubing; there is merely a discontinuous flow of air through it. As the regulator is turned round an obstruction is set up to the entry of air and becomes gradually greater, since the size of the hole through which it must enter becomes smaller and smaller. The intensity of the vacuum produced in the interior of the apparatus is determined by equilibrium being reached between the rate at which air enters it through the air leak and that at which air is extracted by the pump from it. The same factors are responsible for the difference in the amplitude of the periodic variations in its intensity (the vibrations or interruptions of Barraquer) when the vacuum is high and low in degree. But before proceeding to elucidate these points I wish for the sake of convenience to make one change in Barraquer's terminology. On page 58 he says that the intensity of the vacuum required varies between 50 and 70 cm. Hg. These figures clearly refer to the difference between the pressure of the atmosphere, 76 cm. Hg, and the mean pressure of the air inside the apparatus. But the intensity of the vacuum is more correctly measured in terms of the latter—that is the custom in most physical experiments on expansion of gases. That is to say, Barraquer's vacua of 50 and 70 cm. Hg would be better described as being of 26 and 6 cm. Hg. It is a small point, but helps to simplify the explanation of the diagrams in Figs. 4 and 5.

We must first make sure of our definitions. What exactly is meant by the phrase "rate of air flow" through a hole or channel?

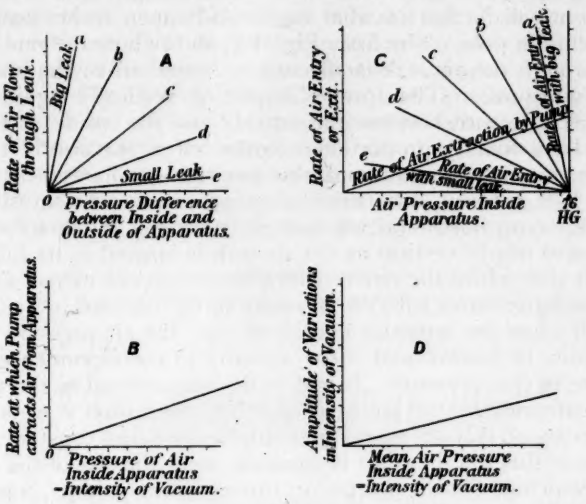


FIG. 4.

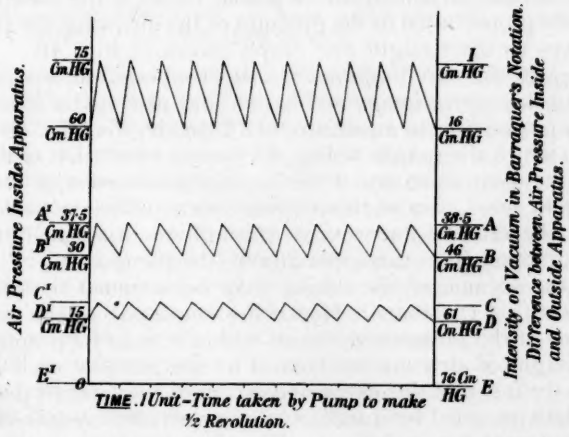

Air Pressure Inside Apparatus.
75 Cm HG
60 Cm HG
A' 37·5 Cm HG
B' 30 Cm HG
C'
D' 15 Cm HG
E' 0
1 Cm HG
16 Cm HG
38·5 Cm HG A
46 Cm HG B
C
61 Cm HG D
76 Cm HG E
Intensity of Vacuum in Barraquer's Notation. Difference between Air Pressure Inside and Outside Apparatus.
TIME. 1 Unit-Time taken by Pump to make ½ Revolution.

FIG. 5.

How can we compare one rate with another? The simplest method is to compare units of *weight* of air passing a given point in a unit of time. If we compare units of volume per unit of time we must measure those volumes at the same pressure, for by Boyle's Law

of the expansion of gases the volume of a given weight of a gas is inversely proportional to its pressure.

The graphs in Figs. 4 and 5 are frankly diagrammatic and are based on a deduction of what ought to happen from theoretical consideration only. The first, Fig. 4A, shows how the rate of air flow through the air leak is affected by variations in the intensity of the vacuum. The former is plotted vertically against the pressure difference between the outside and the inside of the air leak. It is directly proportional to the latter, the size of the air leak remaining constant and the ensuing graph is a straight line. The different lines are the graphs with different sizes of air leak, being horizontal when there is no leak at all, increasing in slope to nearly vertical as the air leak is opened to its full size. Fig. 4B shows how the rate at which the pump can extract air from the apparatus varies with the intensity of the vacuum in the latter. It is nil when the intensity is highest, *i.e.*, the air pressure in the apparatus is lowest and rises steadily in correspondence with increase in that pressure. It is directly proportional to the weight of air extracted by the pump at each half revolution if we assume for a moment that the speed of the latter remains constant. The volume of this weight of air is constant, since the size of the empty space which it fills in the piston tunnel cannot alter. Since the weight of a given volme of gas varies directly as its pressure, we see that the rate at which air is passed through the pump must be directly proportional to the pressure of the air inside the tubing. This gives us the straight line graph shown in Fig. 4B.

In Fig. 4C the two diagrams are superimposed on one another by taking the mirror image of Fig. 4A and placing its zero at the point corresponding to a pressure of 76 cm. Hg on Fig. 4B. The points at which the graphs of Fig. 4A intersect with that of Fig. 4B give us the mean intensity of the vacuum produced with air leaks of different sizes, for at those pressures equilibrium is reached between the rates of entry of air through the air leak into, and of its extraction from the apparatus by the pump.

Now the volume of the tubing may be assumed for practical purposes to be constant. Hence the amplitude of the periodic variations of the pressure of the air within it must be proportional to the weight of air extracted from it by the pump at each stroke. For it is the fact that this extraction occurs during a short part only of the time occupied by a half revolution which is responsible for the presence of the variations. We have already seen that this weight is directly proportional to the mean intensity of the vacuum, measured in terms of the actual pressure of the air in the tubing. This gives us Fig. 4D in which the amplitude of the variations is plotted vertically, the pressure of the air in the tubing horizontally, and the resulting graph is a straight line.

In Fig. 5 the same thing is represented in a form which better strikes the eye, the pressure of the air inside the tubing at any instant being plotted vertically, the time horizontally. The resulting curves show the periodic rise and fall of the former, and how this is greatest when the vacuum is on the point of collapsing, is practically nil when it is most intense. Compare this with the tracings in Fig. 6 (Fig. 58 of Barraquer's article) quoted from Gallemaerts and we see that they represent the same thing, only that in the latter the intensity of the vacuum is not measured in absolute terms, but in terms of the difference between the air-pressure inside and outside the apparatus, *i.e.*, in Barraquer's original notation. Hence the two tracings are inversions of one

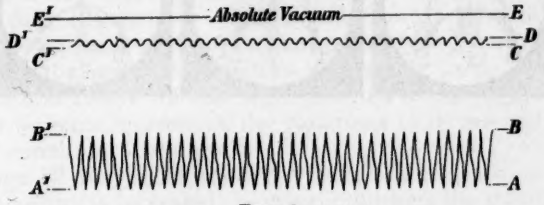


FIG. 6.

Fig. 53. From Barraquer showing tracings of vibrations by Prof. E. Gallemaerts. The lines A, B, C, D, A^1, B^1, C^1, D^1 and EE^1 have been added for purposes of comparison with Fig. 5. The position of EE^1 has been calculated from the equation AB/AE=CD/CE and since AB=8 mm., BC=12 mm., CD=15 mm., therefore DE=3 mm. approximately.

another, with but one slight difference. In my diagram the frequency with which the "vibrations" occur is represented as the same whatever the intensity of the vacuum on the assumption that the pump maintains a constant speed throughout. Now this is not quite a reasonable assumption, for one might expect that there would be some difference in the load on the motor with a difference in the intensity of the vacuum against which it had to work—hence the speed at which it would drive the pump would vary too. This view is confirmed from Professor Gallemaerts' tracings, for the ratio of the frequency of the "vibrations" at a high and a low vacuum is as 34.5 to 38, and is substantiated in the text, for on page 100 it is stated that: "In an Erisifaco that low voltage will operate because it has been constructed and arranged in accordance with the density and viscosity adequate for it. The number of the interruptions increases as the intensity of the vacuum is diminished by the regulator."

It is clear then that the "vibrations" or "interruptions" of the vacuum in the Erisifaco are present all right, though I have heard men deny that they exist. I think my explanation of how they are produced and of the way in which they vary is sound.

Now we must consider the claims made for these vibrations. In Figs. 7 and 8, I reproduce diagrams from Barraquer's article to illustrate what is said to occur, and quote chapter and verse from the text in support of these diagrams. On page 90 the Figs. 99 and 100 represent two cataracts; the first extracted by an Erisifaco poorly regulated with insufficient altitude of vibration; the second shows a "correct" extraction. We note with the aid of a binocular immersion (?microscope) the different lengths of

Fig. 7.

Figs. 92, 99, and 100 from Barraquer.

Fig. 8.

Figs. 38 and 28 from Barraquer.

its fibres and compare both with those of a lens removed with a forceps (Fig. 92). Opposite these diagrams I have placed some others in Fig. 8 which represent the reverse side of the medal, the state of the eye, as represented by Barraquer, after facoerisis, after Daviel's operation, and during expression of the lens by brute force applied from without. After the first there is a horrid mess, after the second all looks clean and tidy, the intact zonule hanging in a neat fringe from the ciliary body. But in the last of the three the artist seems to have made a slip of the pen. The lens capsule seems perfectly smooth and the whole of the zonule is depicted as remaining attached to the ciliary body just as after facoerisis. I have no doubt that Barraquer will correct this in the next edition of Dr. Fisher's book, for surely, in this method the

zonule is torn out by its roots leaving the ciliary body in a sorry state, torn, harrowed, and bleeding?

We now have to deal with the instructions given for the regulation of the Erisifaco in practice. On page 58 we find: "The intensity to be used in each case varies between 50 and 70 cm. Hg according to the elasticity of the lens or the state of maturity of the cataract. These figures hold a certain relation to the age of the subject; the only thing that indicates the degree of vacuum to employ in each case is the practice of making preliminary and careful examination of the cataract—Fig. 110." Figs. 108 and 109 of Barraquer's article might equally well be referred to here, for the three represent respectively (*a*) a slit-lamp and corneal microscope (*b*), a way of using them, and (*c*) what is seen with them. Then on page 104 we find—"The Erisifaco is a pneumatic forceps and zonulatome and ought to be kept perfectly regulated in accordance with the physical condition of the eye to be operated." It is clear that before we can begin to think about regulating the Erisifaco we must understand the variations to be met with in the physical condition of the eye.

On page 82 Barraquer states: "With the cataractous process zonular fragility is increased; in myopic subjects the zonula is also more fragile than in emmetropes and hypermetropes. In zonulas of individuals more than 40 years' old the linear stretching amounts to only one millimetre which these fibres can stand, whereas in young individuals its elasticity is so great that the elasticity may be twice as much. A weight of 30 grams suffices to break the zonula in an emmetropic eye, more than 40 years old, whilst in the cataractous this weight diminishes in proportion to the maturity of the cataract." This statement is not in accordance with Colonel Smith's experience, which is that the strength of the zonule decreases progressively from childhood to old age, myopes being no exception, and is in general unaffected by onset of the cataractous process. The exception is that if the cataract takes the Morgagnian line of development the strength of the zonule is reduced below the normal for the age of the particular patient. The type of cataract which he has called "hypermature ab-initio," and is also known as disciform, develops at a comparatively early age, 30 to 40 years, and therefore has a strong zonule, while its capsule is incidentally very tough. But this summary is based solely on his interpretation of the sensations of his finger tips, while Barraquer's statement is supported by diagrams and illustrations of exact scientific laboratory experiments. I have, however, come across one difficulty in repeating his experiments for the purpose of confirming his results. He recommends the eye of the cadaver for the performance of these experiments. I have searched England in vain for an institution which will

provide me with human eyes containing mature cataractous lenses. Perhaps Barraquer will help me out of my difficulty by informing me of the source from which he obtains his material? He might also explain how he correlates the physical conditions of cataract in life and after death for practical purposes. In practice every structure in the eye becomes more and more

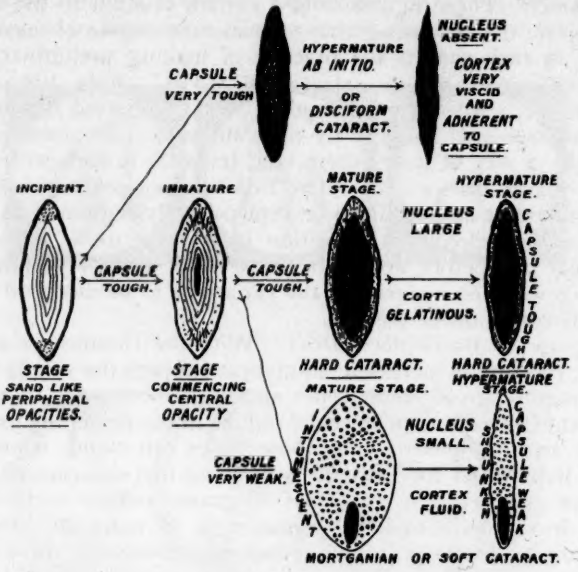


FIG. 9.

Types and lines of development of senile cataract. Diagrammatic.

fragile every hour that passes after death. What inference can be drawn from experiments on such eyes?

On pages 99, 100, and 101, we find Barraquer employing a terminology which agrees better with that employed by Colonel Smith (Fig. 9). He makes clear the distinction between the Morgagnian or soft, and the hard cataract, though he does not allude specifically to the disciform type. He evidently agrees that the zonule becomes progressively stronger as we pass up this ladder, for he says (page 101): "The surgeon ought to try to regulate the intensity of the vacuum in proportion to the hardness of the cataract, which may be determined with great accuracy by the examination of the patient with a dilated pupil, measuring the depth of the anterior chamber and the distance between the two capsules, determining if there are any transparent portions in the lens, by means of the focal illumination of Gullstrand and the

corneal microscope of Zeiss with the graduated drum." It would be interesting to know how Barraquer manages to see the posterior lens capsule when the lens is entirely opaque; for I was not aware that Professor Vogt himself claimed such powers for the slit-lamp. And I fail to see what information he would gain by it, for the Morgagnian cataract has just as weak a zonule and nearly as delicate a capsule in the shrunken stage, when all the soft matter has been absorbed, as in the stage of intumescence or greatest swelling.

Now for the influence of the type and stage of development of the cataract on the strength of the lens capsule. Barraquer states on pages 99 and 100: "A very hard cataract causes more deformity than a white one on account of the great necessity of a very intense vacuum, whereas a white soft cataract is deformed with more facility, and like that in the stage of intumescence the capsule is distended and drawn; a less intense vacuum causes an exaggerated deformity and may produce its rupture." Some hard thinking is needed to interpret this passage. To my mind the only construction it will bear is that the more nearly a cataract approaches the soft Morgagnian type the weaker is its capsule, which is in agreement with Colonel Smith's experience in as far as senile cataract is concerned. And I think that in connection with the strength of the zonule we can bring order out of chaos by assuming that Barraquer is confusing maturity with softness and in reality agrees with Colonel Smith that in a patient of any given age the softer the cataract the weaker is the zonule. In short that age in any given type determines the firmness of the anchorage of the lens.

Let us apply to these facts the basic principle which is claimed to underlie facoerisis, that the greater the "altitude" of the vibrations the nearer to the suction cup of the pneumatic forceps is the point at which the zonule is ruptured. It would be logical to extend the application of this principle and to include the lens capsule in its range, assuming that with excessive "altitude" of the vibrations the latter and not the zonule would be ruptured. On page 59 Barraquer states: "As the intensity corresponds to the height of the wave, with insufficient intensity the fibres of the zonule do not rupture, with an excessive intensity we may break the capsule." To my mind the first sentence of this paragraph can only be taken to bear out my previous presumption—that with excessive "altitude" of the vibrations there is danger of bursting the lens capsule and not the zonule. Otherwise why was it included in the paragraph at all?

Now the plain commonsense view would be that a high vacuum is more likely to burst a weak capsule than a low one. Barraquer subscribes to this view frequently, both in the remainder of the paragraph—just quoted, in the paragraph quoted previously from

pages 99 and 100 in which he gives his views of the physical condition of the different types of cataract and again on page 72, where he states that: "Rupture of the zonule may occur at the moment the cataract is drawn upon, indicating that we have made a mistake by employing a vacuum of excessive intensity." But it is puzzling when one tries to reconcile this commonsense view with the vibratory theory. For I have previously shown that the correspondence of the intensity is, measured in Barraquer's notation, a correspondence in inverse proportion. The two aspects seem irreconcilable.

Finally, we must consider the adjustment of the intensity of the vacuum and the "altitude" of the vibrations to the strength of the zonule. We are agreed that in a patient of a given age the strength of the zonule decreases *pari passu* with the softness of the cataract. It would again be only plain commonsense to agree that with a strong zonule, in a hard cataract, the suction cup of the pneumatic forceps ought to have a firmer grip than with a weak zonule, for it would be more liable to come off when we pulled. Barraquer again subscribes to this view frequently, to requote from pages 99 and 100: "A hard cataract causes more deformity than a white one on account of the great necessity of a very intense vacuum," from page 101: "The surgeon ought to try to regulate the intensity of the vacuum in proportion to the hardness of the cataract." But again there comes a difficulty in fitting this in with the vibratory theory. For, with a very intense vacuum the "altitude" of the vibrations is nil, with a low degree of intensity they are at their greatest. How does it come about that the stronger the zonule the weaker, on this view, are the vibrations suited to its rupture, the weaker it is the greater must be their amplitude? One seems to catch a glimpse of Barraquer himself being a little perplexed about the matter, for in the second paragraph on page 100 he seems to contradict his instructions which immediately precede and follow. He states: "When the cataractous process is less advanced as a rule the zonule is less friable, which necessitates the employment of a greater number of interruptions of the vacuum. In an Erisifaco the number of interruptions increases as the intensity of the vacuum is diminished by the regulator," *i.e.*, the machine moves faster as the load is diminished. In fact within the space of twenty lines of print he first recommends a vacuum of high intensity for the extraction of a cataract whose zonule is tough, and in consequence low "altitude" of vibrations, then the reverse, and finally returns to the original instructions. But I am sure Professor Barraquer will be able to explain these apparent inconsistencies to my satisfaction. I have been unable to study his writings in the original Spanish text, and the explanation must lie in errors which have crept in during its translation into English.

So much for the theoretical aspect of facoerisis. I was fortunate enough to have been able to study its practical aspect during the last winter, when I had the opportunity of visiting and working at

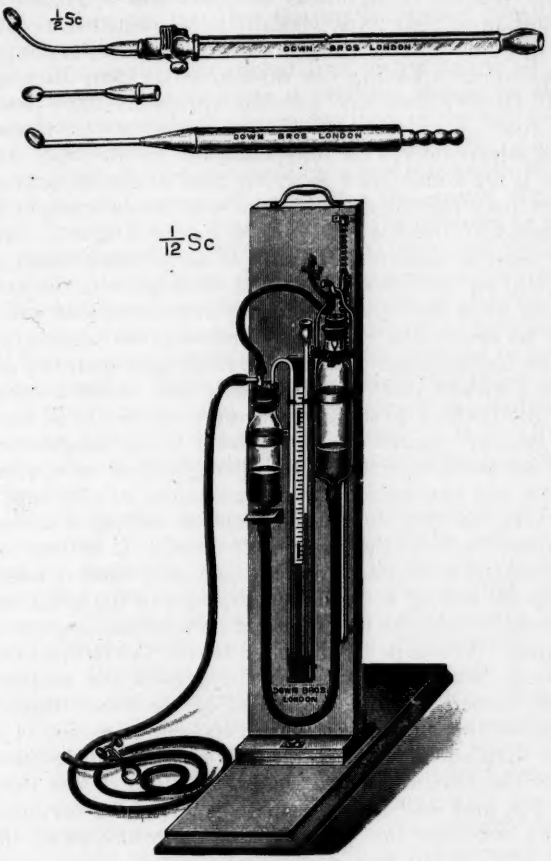


FIG. 10.

Down's mercury vacuum apparatus.

a number of clinics in Northern and Western India, where intracapsular extraction of cataract is performed on an extensive scale. I have seen in action most of the methods which are before the profession at the present time, including the "pneumatic forceps" with both Down's mercury vacuum apparatus (Fig. 10) behind it and Barraquer's latest type of outfit. The men whom I saw at

work were very highly skilled in the technique of expressing the lens in its capsule by pressure from without, and had the experience of some thousands of cases to their credit. They had acquired by long practice a lightness of touch and a dexterity in the manipulation of their tools which is to be gained in no other way. Yet at the time at which I saw them at work with the pneumatic forceps they were having one disastrous accident after another.

With Down's mercury vacuum apparatus there was such a violent rush of air through the anterior chamber, if the suction cup was misapplied to the lens when the vacuum was transmitted to it, or if the zonule was so strong that it lost its hold and came off when they pulled, that the lens was blown straight back into the vitreous, to be recovered with difficulty if at all. The control of the vacuum was in the hands of an assistant who pressed a spring clip on the rubber tubing to transmit it to the suction cup when the word was given. He had instructions to shut if off at once if he heard the hiss of air entering the suction cup. But before he could possibly have time to do so a quantity of vitreous had been sucked into the apparatus, and could be seen in the watery fluid which gradually accumulated on top of the mercury in the vacuum chamber. I suggested to the surgeon concerned that, if his assistant released the spring clip at once when he had pressed it and transmitted the vacuum to the suction cup, the latter would keep its grip on the lens just as well as if it was still in communication with the vacuum chamber. If it came off during the subsequent manipulations air would only enter in small amount to fill up the tubing as far as the clip, not in the great rush which was inevitable with the way in which he was handling the apparatus at the time. When he tried this he found it to be the case. When the zonule was too strong for the grip of the suction cup no disasters ensued when it was pulled off the lens. But this initial stage is not the only one at which its grip can fail. I saw it do so more than once even after the lens had been dislocated. When it did so the vitreous, which was sucked into it, was now held up at the clip, and instead of passing over into the vacuum chamber streamed out from the handpiece on its withdrawal, like a thin watery jelly, in full view of the audience.

Barraquer's pump does not suck air in through the open spoon as fast as does the mercury vacuum apparatus. With it there is in consequence less danger of the lens being blown back into the vitreous if things go wrong. The accidents I saw with it were a little less frequent and a little less violent. But despite the addition of the vibrations the log book still showed a sorry tale of woe. Burst capsules I exclude from consideration, for they were clearly due to faulty diagnosis and regulation of the apparatus, not to lack of manipulative skill. But there was to my mind a prohibitive

proportion of cases in which the lens had to be dug up out of the vitreous with a spoon, or was lost not to be seen again.

The situation puzzled me. For though a man might publish that he had failed a thousand times with the Erisifaco, he would still have to face the fact that Barraquer himself can do the job with it perfectly. Everyone who has seen him at work, either in Barcelona or elsewhere is agreed that in his hands all goes like clockwork. What one man can do another should be able to do. Yet here were men making a complete hash of the job, over whose skill and experience I will not grant Barraquer the right to claim any superiority. I tried my hand on a few cases with Barraquer's apparatus and had no more success than the others. The mystery deepened, though once I thought I saw the glimmer of a solution in that ancient maxim: "The diagnosis first and the treatment afterwards." It might be that the diagnostic armament was at fault. We had to rely on the unaided powers of observation of the naked eye, for there was no slit-lamp at hand to help us.

I had had for long suspicions about the accuracy of some of the statements made in Barraquer's article and had failed to confirm certain of his findings, and a chance remark coupled with statements in an article by Capt. Cruickshank, I.M.S. (*Brit. Jl. of Ophthal.*, July, 1925) gave me the clue to what seemed the solution of the problem.

Are the vibrations, such as they are, responsible for the zonule being ruptured close to the periphery of the lens when it is extracted by facoerisis, and is it dragged out by the roots from the ciliary body, as is implied to be the case, in other methods of extraction? The whole of the claims for facoerisis have been built on the hypothesis that both these things occur. It is not sufficient for Barraquer to demonstrate the truth of the former alone, he must also demonstrate that of the latter. Now since the earliest days in which Colonel Smith began to express cataract in its capsule by "brute force" this question of where the zonule gives way has interested him. He always showed visitors to his clinic that no trace even of tags of the zonule were visible on the capsule, however examined; much less, the veritable halo which Barraquer would have us believe should have surrounded the lens. Early in 1921, on a visit to Barcelona, both Barraquer and he extracted a lens by their respective methods. The elder Professor Fuchs (late of Vienna) who was present, examined and said: "In the hands of the two experts I see nothing to choose." I have yet to meet anyone who can demonstrate any difference, in the matter of the presence of tags of zonule, between senile cataractous lenses, extracted in their capsules from the living human eye, which is in any way dependent on the method by which they were extracted.

The inconsistencies present in Barraquer's own account of how to "regulate" the vibrations in accordance with the physical conditions in the eye to be operated on should be obvious. He is convicted out of his own mouth. For on page 96 he says that when he operated with a constant vacuum he "ruptured the fibres of the zonule to extract the lens which then appears with a crown of zonule fibres like the representation in Fig. 92." This diagram

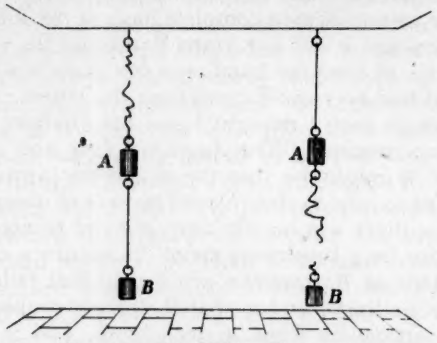


FIG. 11. FIG. 98 from Barraquer.

Experiment by Prof. T. Escriche explained in the text of pp. 87 and 89. "A physical experiment explains clearly the different ways to make a force continuous or instantaneous; we suspend a thread from the ceiling; at its extremity a weight (*A*); at the inferior extremity of the weight another thread of the same resistance as the upper one with another weight (*B*) on its end; if the sum of the two weights represent a force greater than the resistance of the thread when it yielded by suspending slowly the weight (*B*), the thread is broken by the weight (*A*) if the force is represented by the sum of the two weights in the act above, all along the length of the thread; if we raise the inferior weight and drop it suddenly, the force has not time to transmit itself as far as the upper weight and the thread escapes at some centimetres from the inferior weight, notwithstanding a lesser weight was used."

(reproduced in Fig. 7) shows the lens with what clearly is intended to portray the whole zonule attached to it. Yet in the very next sentence he tells us that "by examining those patients with the corneal microscope it was noticed that, in some, remains of zonule fibres are incarcerated in the lips of the wound." I need say no more. The vibrations, such as they are (for as a matter of fact they hardly exist at all), have absolutely no influence on the place at which the zonule ruptures.

There is one other aspect of the action of the vacuum in dislocating the lens which deserves attention. Reproduced in Fig. 12 is a diagram which figures repeatedly in Barraquer's article. It purports to show how the lens is dislocated immediately by the application to it of the vacuum and vibrations. One point about

it at once strikes the eye as queer—for though the lens capsule is intact, the nucleus is portrayed as being displaced through the soft cortical matter towards the suction cup and gripped by it. In the text (page 57), the representation is confirmed: "By the rarefaction of the air in the suction cup, it adheres to lens . . . . deforms it

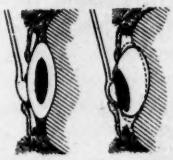


FIG 12. FIG. 57 from Barraquer.

Barraquer's representation of effect of applying vacuum, *i.e.*, immediate dislocation of the lens in *all* cases, and the nucleus being gripped by the suction cup *through an intact capsule*.

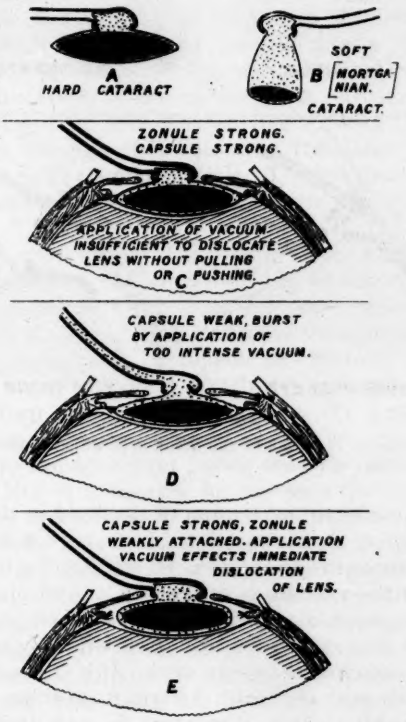


FIG. 13.

Representation of actual sequence of events when vacuum is applied.

by shortening its greatest diameter *and displaces the nucleus.*" A simple experiment with fresh human cataractous lenses will serve to convince us that this unlikely happening does not in fact take place. The capsule and as much soft fluid cortex as it will hold is sucked into the suction cup. If the nucleus is large and the cortical matter small in amount the capsule is drawn tightly round the former. If the cataract is of the Morgagnian type, the

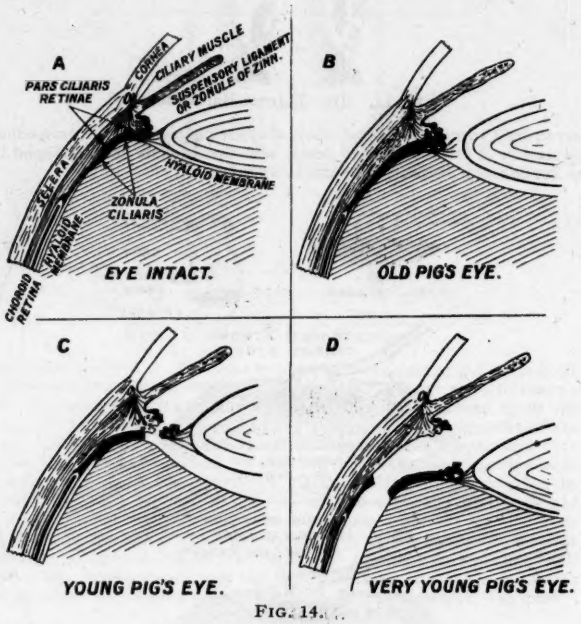


FIG. 14.

198 Natural planes of cleavage in the structures which anchor the lens to the fibrous coats of the eye.

small nucleus sinks to the bottom of the fluid in the bag in which it is contained. Applying these facts to consideration of the sequence of events inside the eye, we see that the only effect of the application of the vacuum is to take up a little of the slack in the anterior lens capsule. What happens then depends on the circumstances (Fig. 13) for this by itself will only effect dislocation if the zonular attachment is very weak. If it is strong the moorings of the lens will not part until the strain on them is increased by pulling or pushing, and when they do part they will do so at their weakest point, vibrations or no vibrations. On the other hand the capsule may burst, if it is weak in relation to the intensity

of vacuum employed, the suddenness with which the latter is let on, or the sharpness of the edges of the suction cup.

An experiment on the eyes of young animals fresh from the slaughter house (pigs' eyes are very suitable) gives us interesting information as to the situation of these weak links in the chain which moors the lens to the fibrous tunic of the eye (Fig. 14). The age of the pig may be estimated roughly by the size of the eye. Make a section which admits of an easy passage for the exit of the lens. Punch it out boldly by pressure applied from the outside so as to bring it out upside down. In the eyes of the older animals the zonule can be seen to strip off the capsule of the lens and leave the latter quite smooth and bare. In younger animals the zonule comes with the lens, but brings with it a narrow black pigmented fringe consisting of that part of the epithelial covering of the ciliary body (the pars ciliaris retinae) which overlies it and to which it is attached. In the youngest animals the continuation of the zonule back into that thickened portion of the hyaloid membrane which is termed the "zonula ciliaris" is so strong that the whole hyaloid and vitreous come with the lens. With them is brought the whole of the pars ciliaris retinae, which encircles the lens, as it sits on the vitreous, like a broad black halo. It is simple to cut through this halo into the canal of Petit and to extend the cut right round the circle. The lens peels off the vitreous and the hyaloid membrane which lines the patellar fossa is clearly displayed.

I should warn the reader that the pig's eyes must be fairly fresh, for in the process of decomposition the attachment of the zonule to the lens capsule is the first place to be weakened.

Now though Colonel Smith has more than once been successful in expressing cataract in its capsule in children, yet, in them the zonule is as a rule so firmly attached to the capsule that he has long since given up doing it as routine. It is not because he is afraid that the pressure required, which is considerable, would be injurious to the structures inside the eye. Nothing of the sort is the case. Nor is it because he has seen the lens bring with it a black halo of epithelium off the ciliary body as in the case of the young pig's eye. It is because in most cases the pressure required is such that it is difficult to prevent the instrument from plunging, when the zonule loses its hold, and so expressing a quantity of vitreous with the lens. In very rare cases of cataract in childhood the lightest touch will suffice for dislocation, but they are so rare as to be a curiosity, impossible to diagnose before operation.

Knowledge of these facts led me to think more than once over a chance remark by an American surgeon who had just visited Barcelona. He had seen Barraquer take out a congenital cataract in a child "perfectly." The whole tone of his remark gave me the

impression that Barraquer had laid his hand to that child's cataract without the quiver of an eyelash, absolutely sanguine of success, and had regarded it as just an ordinary everyday-routine event. Now, what I had seen of the "pneumatic forceps" in action had convinced me that, even with the machinery behind it in perfect working order, its grip was inadequate for the removal of any but the most lightly anchored senile cataract by pulling. For I had frequently seen it lose its hold and come off when the zonule was but a little over the normal in strength. Yet here was Barraquer achieving success with a cataract whose anchorage was ten times as strong as that of any on which I had seen his instrument fail. It became clear to me that his success in that case could not have been achieved by pulling. He must have dislocated the lens by pushing it boldly back into the vitreous, a course which would impose no strain on the grip of the instrument which it was not fit to stand. The vitreous would press well forward round the periphery of the lens to fill the space vacated by the latter. But there is no reason why it should do more than this, why it should come forward in front of the iris, or come out of the eye. For Barraquer applies no pressure to the outside of the walls of the globe to deform them, and so to reduce the capacity of the vessel in which the vitreous is contained (Fig. 16).

I then recalled to my mind the article before mentioned, by Capt. M. M. Cruickshank, I.M.S., who has, I believe, been up to the present the most successful exponent of the art of facoerisis in the Indian Empire. He himself seems to believe firmly that he is getting the lens out by pulling. But his instructions as to how to avoid disaster display plainly, when read between the lines, that he is actually doing nothing of the sort. Labouring under the misconception, whose fallacy I have already pointed out, that the suction cup actually *grasps* the *nucleus* through the capsule, he goes into an elaborate explanation of why the surgeon must not attempt to turn the lens over on its back inside the eye before extracting it, by simply rolling the handle of the pneumatic forceps between the thumb and fingers. In it, however, he seems to have missed the real reason, which is that while the lens must be rotated about a transverse axis which lies in the plane of the suction cup, the shaft and handle of the instrument are set at an angle of about 45° with that plane. This at one and the same time gives the surgeon a leverage which enables him to apply immense force to the lens without realizing it, and compels him in using the instrument to swing the handle about that axis by movements of pronation or supination of the wrist and forearm. When one sees superadded to this, movements of the elbow and shoulder joints, with perhaps the hand not even steadied on the patient's head, one realizes that under these conditions the sensations of the finger

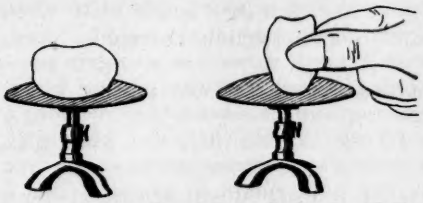


FIG. 15. FIG. 102 from Barraquer. Compare with FIG. 14 D.

I must compliment Barraquer on the skill with which he has dissected the ciliary epithelium off the zonula ciliaris of the hyaloid membrane, *a feat which I have not been successful in repeating myself.*

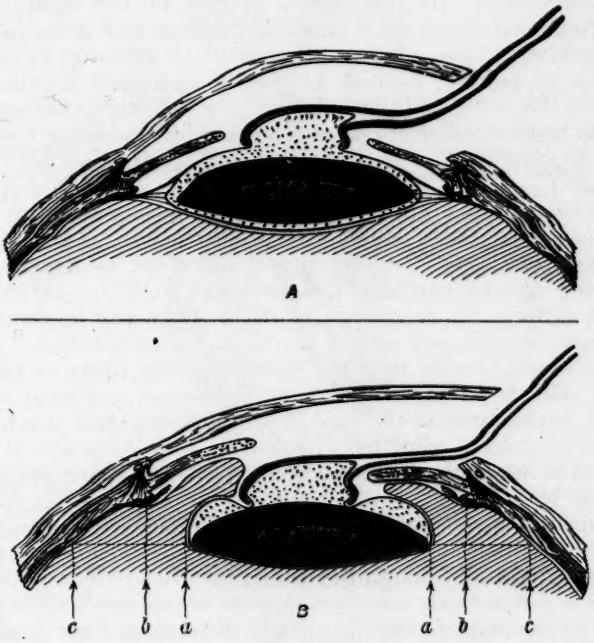


FIG. 16.

In A the suction cup has gripped the lens, but the zonule is too firmly attached for dislocation to be effected by pulling. In B, the lens is shown pushed back quite a short way into the vitreous, which has *burst its way forwards, through the hyaloid membrane and the* zonule, but does not come in front of the plane of the iris, as there is no pressure on the outside of the globe to make it do so. Note two things. First the extra space given by this manoeuvre both from side to side (*cb*), and from front to back behind the cornea, second the way *in which the shaft of the pneumatic forceps is set at an angle of 45° to* the transverse axis, lying in the plane of the suction cap, about which the lens must be rotated.

tips will by themselves be a poor guide as to what is happening at the business end of the pneumatic forceps. And even they are blunted by the fact that it is necessary to grip the instrument the whole time in order to keep the valve pressed which transmits the vacuum to the suction cup. I was told by one man, who previously had been very successful, that there was some trick in the use of the instrument which his hand would take a little time to re-acquire, but which he could not explain in words. The reason for this difficulty in explanation was simple enough. He was under the impression that his fingers had been pulling on the lens while in reality they had been pushing.

Let us re-examine Barraquer's diagrams and his instructions for manipulating the pneumatic forceps in the light of the hypothesis that the secret of safety and success with it lies in using it to remove the lens as much as possible by pushing, as little as possible by pulling, because its grip is inadequate for the latter course. We shall find that it gives us a rational explanation of how he has arrived at his present method of "tumbling" the lens so as to deliver it lower edge foremost (page 63—"My Usual Method").

In Cruickshank's article it is said that during the final stage of delivering the lens in this way it must not be pressed against the posterior surface of the cornea under the impression that by doing so any tendency for the lens to slip, or be dragged off the suction cup, as it engages the incision, can be prevented. The natural inference would be that such an accident, among others, would thereby be made more, not less, likely to happen. If the smooth posterior surface of the cornea can form such a serious impediment in the way of safe delivery, how much more serious an obstacle must be presented by that sharp scleral lip of the wound when the lens is brought out head first. Accidental pressure with the lens against it is a thing which is not unlikely to happen in that method of delivery. For in it the suction cup remains in front, the lens behind against the scleral lip, during the actual passage through the wound.

This is not the only way in which the scleral lip is an awkward corner to negotiate during the upright delivery with the pneumatic forceps. The cohesion between the posterior surface of the lens and the vitreous, two smooth moist surfaces perfectly adapted to one another, is such that, if an attempt is made to separate them by pulling the lens straight forward, the vitreous will tend to stick to it and hold it back. The grip of the suction cup may be inadequate to the task of pulling them apart in this way. It may lose its hold if asked to do so. Then as we have seen trouble begins. The lens must be disengaged from the vitreous by swinging it round on a transverse axis so as to slide apart the two

surfaces in contact. (*See* Fig. 17, A and B, that is Fig. 33 from Barraquer in which he himself recognizes this fact.) In upright delivery the nose of the lens may strike against the inner surface of that scleral lip of the wound. It will stay behind unless it is lifted over the stile by pulling it forward, and pulling is gambling with fate. (*See* Fig. 18.)

Finally, we can see from Barraquer's own account, that even the intact iris presents an obstacle to upright delivery, which he

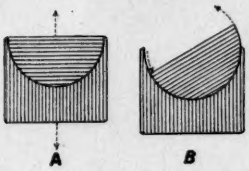


FIG. 17. FIG. 30 from Barraquer.

"In A, by making pressure in the direction of the arrows, adhesion prevents us from separating the convex lens from the concave, if the two have identical curvature. It is necessary to disarticulate them as in B, to accomplish a movement of rotation."

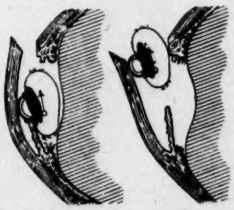


FIG. 18. FIG. 64 from Barraquer.

Showing upright delivery. Note how the lens is represented as being *pulled* forwards off the vitreous in order to clear the awkward projection of the scleral lip of the wound. Yet Barraquer himself in Fig. 17 demonstrates the difficulty of so doing.

may not be able to surmount. For in that method the instrument must be asked to pull the lens through the pupil and it is more than likely to jib at the task. This is the only reason which I can see for his statement under Fig. 31 of his article "In cases of hard cataract total extraction succeeds only and invariably with an iridectomy." The picture represents a cataract being delivered upright in its capsule, impaled on a needle. I have no experience of this particular method but in so far as simple straightforward expression from without is concerned Barraquer's statement is entirely untrue. With it there is no difficulty whatever in pushing the lens through a pupil contracted to a pin point with opium; it is only a matter of patience. Again on page 53 he says, "If it is

a question of a more voluminous cataract, very intumescent, an iridectomy is indicated."

The secrets of success are now plain. Any lens can be dislocated with perfect safety by pushing it boldly back into the vitreous. Once dislocated "version" can be done without fear of accidents, by working back in the vitreous where there is plenty of room. (*See* Fig. 16B and note on page 20 of Cruickshank's article, the warning against striking the lower edge of the lens against the sclero-cornea.) Once the suction cup is behind the lens it can be disengaged from the vitreous and got through an intact pupil by *pushing instead of pulling*. And, finally, when it has got into the anterior chamber it can be negotiated round that awkward corner formed by the scleral lip of the wound with the back of the suction cup against it instead of the back of the lens.

There is one point which requires emphasis, the matter of making sure that the lens is completely dislocated before beginning to do the version. When I re-examined, in the light of the hypothesis of pushing instead of pulling, the events in the very few cases on which I had used Barraquer's instrument myself, the reasons for my success and failure became apparent. I had been successful with the hard cataract and had failed with the soft (burst capsules are here expressly excluded from consideration, as they are a matter of faulty diagnosis rather than faulty manipulation).

I had started on a movement of pronation of the forearm as soon as I had got hold of the lens, so driving its upper border back into the vitreous. In the former type the pressure I was making unawares on a rigid body had dislocated it below as well as above and all went well thereafter. In the soft cataract the suction cup simply slid over the small nucleus, which was floating in fluid cortical matter, and the zonule remained attached below. Then when I tried to swing the lower edge of the lens up through the pupil I had to begin pulling. There was a tug-of-war between the zonule and the suction cup in which the former had the mastery. The cup came off and the lens dropped back into the depths of the vitreous from which it had to be dug up with a spoon.

Here is the point at which to draw attention to Barraquer's Instructions on page 71: "In case the iris gets between the lens and suction cup. It suffices after having given the lens the turn within the anterior chamber to interrupt the passage of the vacuum allowing entrance of the atmospheric pressure into the suction cup by which the cataract is loosened and to take hold again." Now while this course is quite feasible if the iris is caught up in the suction cup above or at one side, it is not possible if it is caught up below. For then the lower border of the lens cannot be swung up through the pupil; the cup comes off; and the lens is lost.

The moral to draw from this is that the surgeon who uses the pneumatic forceps should be particularly careful not to ensnare the iris below and should always commence by dislocating the lens below, pressing it backwards there by supinating the forearm, then turn his attention to the zonule above, detaching it there by pressing backwards with a movement of pronation. Only when he is certain that the lens is completely dislocated should he begin to do the version. While doing it, in the words of Capt. Cruickshank, he must not attempt to steady an unruly eye with the instrument. He must be in no hurry whatever, but must exercise his patience and go dead slow from start to finish. And above all his hand must not tremble. For if he does any of these things he may inadvertently strike the lens against one of the numerous obstacles which lie in its path, and drag if off the suction cup. If it slips off after it has been completely detached from the zonule, there is nothing to prevent it from dropping back into the depths of the vitreous, never to be seen again. For the hyaloid membrane, lining the patellar fossa, has been torn to shreds and can give it no support from the rear.

Having formulated this hypothesis I put it to the test of practice on embedded pigs' eyes. To my joy I found everything go smoothly. After a time I became wildly enthusiastic over the merits of the pneumatic forceps for it became clear to me that could I lay my hand with it to a congenital cataract in the eye of a foetus as yet unborn, there would be but one thing which would baulk me of my prey. Should the subject not have reached the stage of development at which the remains of the hyaloid artery have disappeared I would have to start pulling in order to rupture them, and that would be fatal to success. And I would be a little apprehensive that in the event of success the lens might emerge crowned with an artistic black halo of epithelium off the ciliary body. For the weakest link in the chain which moored it to the fibrous tunic of the eye would be the one which would give way, vibrations or no vibrations.

I think it is fairly clear that Barraquer's instructions are not likely to assist his would-be disciple in succeeding with his method. Turn to the "Advice to the Beginner," on page 103. Section 5 enjoins him: "Do not in your first operation try to change in the least possible way the details of the technique described, and be most exact in following them out." If the beginner wishes to succeed in his first operation he must depart radically in every particular from the technique described, from the very first step to the very last. On page 49 a section "including the superior 2/5 of the cornea" is recommended. It is next door to impossible to express cataract in its capsule by pressure from without through a routine incision of this size—the minimum safe standard is half

of the corneal circumference, or 180°. With the bulk of an instrument added to that of the lens 190° is the minimum, when that instrument has as light a hold as has the pneumatic forceps 200° would be better. This was the size of incision which was being made by the most successful of the men whom I saw at work with it. (In Capt. Cruickshank's article the same thing is emphasized though perhaps not so explicitly.) It is quite a safe size in so far as the vitality of the cornea is concerned.

Barraquer repeatedly utters a warning not to make any pressure with the instrument on the lens, not to compress the vitreous and

FIG. 19. FIGS. 73 and 74 from Barraquer.

Delivery as a Tumbler. Note how Barraquer represents the lens as being rubbed against the cornea from start to finish.

in his diagrams he represents the hyaloid membrane as remaining intact to the end, the vitreous as undisturbed. I do not need to deal with this again. In his illustrations of how he delivers the lens as a "tumbler" (*see* Fig. 19, that is Figs. 73 and 74 from Barraquer) he depicts it as being rubbed against the inside of the cornea from start to finish. I have already quoted Cruickshank's views on that issue but Barraquer himself sheds an interesting sidelight on it. For on page 59 we find a warning not to "produce friction on the posterior of the lens." It is interesting to note that in this passage it is the vitreous, not the lens, for which he is displaying great concern.

Finally, there comes the matter of escape of vitreous. He claims immunity from it on page 74 and both here and on page 74 ascribes this immunity to the use of novocaine to paralyze the orbicularis. Though elsewhere he does allude to the fact that the lids should be held away from the eye, yet he does not tell us whether his assistant who is looking after them is charged with the duty of retracting the eyebrow to guard against the very real danger of the novocaine failing to act.

Now for the benefit of those who may not be convinced that the secret of success with the pneumatic forceps depends on pushing instead of pulling, let me draw attention to the fallacy underlying a belief which has been prevalent in some

quarters:—that less violence is inflicted on the eye when the lens is dislocated by direct traction on the zonule with an instrument which grasps its capsule, than when pressure is applied to the eye from without. If we hark back to our geometry for a moment, we will remember the proposition which states that a given surface encloses the greatest volume when it is in the form of a sphere. Let us regard the sclerotic, the moorings of the lens-capsule to it, and the capsule itself as the walls of a sphere which contains an incompressible fluid, the vitreous. If we deform these walls the volume which they can contain will be diminished. Now whether we do it by pulling or by pushing on them, we will be constraining the vitreous to occupy a smaller space (*see* Fig. 20). Its refusal to do so will compress the structures lying between it and the walls which contain it, and will put the

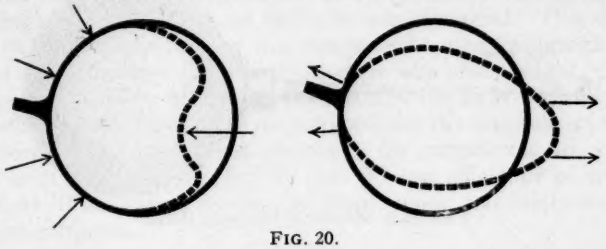


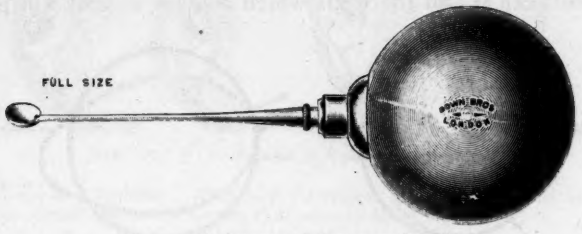
FIG. 20.

To show how volume of a spherical container is diminished equally when its walls are deformed by pushing or by pulling.

latter on the stretch. If we go on deforming them the strain on them will increase until they burst at their weakest point. The compression to which choroid, retina, and vitreous must be subjected, in order to dislocate the lens in any particular eye, is determined by the tensile strength of the particular zonule, multiplied by the length of it which is ruptured in the first instance. The last factor is the only one which is within the power of the surgeon to vary. This compression is therefore least in the method which most nearly concentrates the strain on the zonule on a point —whether it involves pressure on the sclerotic, pressure on the zonule, pressure or traction on the lens capsule, is quite immaterial. The ideal would be achieved if we could use a sharp cutting instrument, but I need not discuss the use of such a weapon inside the eye. A blunt instrument applied directly to the zonule is the method next closest to the ideal, and has taken shape in the so-called zonulatomes to which different men have given their names. But it possesses certain theoretical dangers which are to my mind insurmountable. For at the worst it would be very easy when one is working with such an instrument in the dark behind the iris, to push it down the natural plane of cleavage which passes through

the ciliary body. At best, it would be difficult to be sure that one had not bruised the latter against the sclerotic with the hard metal instrument itself. When these two plans are dismissed, there is absolutely nothing to choose between an instrument which dislocates the lens by pressure on the eye from without, and one of the various types of capsule forceps used to do the same thing by direct internal manipulation. And whether the latter takes the form of pulling on the lens, or pushing, it is quite immaterial. The violence done to any particular eye would be exactly the same.

The pneumatic forceps was as far as I know first introduced into surgery by Stoewers. For an instrument bearing his name figured in Messrs. Down Bros. catalogue for 1906. The next man to take it up was Dr. Vard Hulen of San Francisco, who reported



Pneumatic forceps of Stoewers (1906).

six cases in 1910. Professor Barraquer deserves great credit for the thought and energy which he has brought to bear on the problem of how to use it. But I do not think we can allow his claim to pass, that his instrument is a "vibratory zonulatome" possessed of magic powers, and that his operation consists "in drawing the crystalline lens by its anterior surface, separating it mechanically without either traction or violence of the zonule, and extracting it completely out of the eye without having produced ectopias or traumatism of the intraocular structures." I should like to rechristen the operation and call it "pushing the lens violently to the exterior."

ANNOTATIONS

Illumination and Efficiency

The Industrial Fatigue Research Board and the Illumination Research Committee have recently published a joint report by Messrs. H. C. Weston and A. K. Taylor on the relation between illumination and efficiency in fine work. As a type of the work

required the Committee selected for experiment the operations involved in type-setting by hand. Their conclusions are of considerable importance on both the commercial and scientific aspects. In addition to measuring the total output under varying conditions of illumination, a record was also kept of all mistakes, particularly those in connection with turned letters, as this form of error is mainly due to the failure of the operator to see the nicks on the type. The optimum value of illumination was found to be about 20 foot-candles, an illumination considerably in excess of that usually provided. With illumination as powerful as this, it is, of course, necessary to make careful provision for the avoidance of glare. When the illumination fell below 2 foot-candles nearly one-quarter of the output was lost. With an illumination of 10 foot-candles there was no complaint of ocular fatigue but the output was increased and the number of errors reduced by raising the light to a higher value. Artificial daylight was also tried. This did not meet with the approval of the compositors, and, although there was a slight increase in the output, there was also a slight increase in the total number of errors. As artificial daylight was only used for two days the committee do not consider the question as settled in view of the time found necessary for adaptation to various sources of illumination. In any case the low efficiency of artificial daylight illumination renders its employment too costly for commercial purposes.

"Sesquipedalia verba"

In 1855, James Dixon, Surgeon to the Royal London Ophthalmic Hospital and formerly of St. Thomas's Hospital, brought out a severely practical handbook on Diseases of the Eye. The following extract from the preface may interest our readers, and cause a feeling of thankfulness in us all that we were not in active practice at the time when such words were in use:

"Technical terms are of course as indispensable in medicine as in any other science; they avoid circumlocution, and, if well chosen, carry with them their own definition; but to attempt expressing by single words every process of disease, and every surgical manipulation, imparts a dry and pedantic character to subjects which would be attractive and interesting if described in a simple and natural way. It requires a more intimate knowledge of Greek than one has any right to expect from every student of medicine, to recognize in Irido-periphakitis an inflamed iris and capsule; or at once to detect the operation for closing a lacrymal fistula under such a disguise as that of Dacryocystosyringokatakleisis."

ABSTRACTS

I.—DISEASE OF LENS

(1) **Kennedy, E. W. (Rochester, N.Y.)—Complete ectopia lentis. Report of case.** *New York State Jl. of Med.*, January, 1925.

(1) **Kennedy** after a short outline of the embryology of this condition gives an interesting account of the work done by Stockard, who subjected young fish to exposure to heat, cold, chemicals, fumes, etc. He was able by such exposure to arrest development of the optic vesicles at various stages and to produce defects ranging from cyclopia to the development of practically normal eyes. The case reported occurred in a man, aged 47 years, whose eyesight had always been poor; there was no history of trauma. Both eyes were affected, the irides being tremulous and the lenses lying at the bottom of the vitreous chambers. They were firmly situated there and did not move about on movement of the eyes. The fundi were normal, and there were no colobomata. Vision of the right eye was 20/50, and of the left, perception of light. The patient had four boys and one girl. The eldest boy and the girl showed outward displacement of the lenses, the other three children being normal. There was also a history of "poor eyes" in the father and grandfather.

F. A. WILLIAMSON-NOBLE.

(2) **Rotth, Dr. A. (Pecs, Hungary).—On the question of phaco-anaphylactic endophthalmitis.** *Arch. of Ophthal.*, March, 1926.

(2) **Rotth's** article opens with a review of previous work on this subject which shows that the experimental production of phacoanaphylactic endophthalmitis with homologous lens protein is not proven. This is in direct conflict with the articles published by Verhoeff and Lemoine, so Rotth decided to investigate the subject for himself. A long series of experiments was performed with the following results: (1) Animal experiments. A series of guinea-pigs was given an injection of foreign lens protein (human and pig's lens matter) into the anterior chamber. In two cases out of thirteen there was a marked fall in temperature when foreign lens matter was given intravenously three weeks later. This proves that heterologous lens protein absorbed from the anterior chamber can cause hypersensitivity. In the next series of experiments, the second injection was made into the vitreous; this resulted in a severe ocular inflammation. In the third series a broad

piece of lens capsule was removed from the sensitized guinea-pig instead of injecting heterologous lens protein, and these cases showed no anaphylactic reaction, local or general. The corneal incision often gaped and the cornea itself became hazy but the same signs occurred in non-sensitized control animals. In one case a purulent keratitis spread from the corneal wound, due to a small polymorphous bacillus, and in another a staphylococcal iritis occurred.

The author's conclusion, therefore, is that in animals hypersensitive to heterologous lens protein, the broad opening of the capsule is not followed by any anaphylactic symptoms. In the next experiment an attempt was made to sensitize the animals to their own lens protein by tearing off a large piece of capsule. Subsequent intraperitoneal injection of lens matter obtained from the fellow eye caused no anaphylactic symptoms. A normal animal does not therefore produce anaphylactic antibodies to its lens protein. (2) Experiments on patients. Intradermal injections of lens matter were made with Verhoeff and Lemoine's technique in 106 patients and the result was, in every case, negative, but, by increasing the dose of lens matter injected, 10 of the cases showed a positive reaction, and, on increasing it still further, a higher percentage of positives was obtained. Two of the ten patients mentioned were operated on for cataract, and made an uneventful recovery. A further point is that a real anaphylactic reaction should develop within twenty-four hours after operation, whereas in Verhoeff and Lemoine's cases, the reaction did not develop until three to five days later. The author therefore believes that "most cases of post-operative late iritis are caused by infection."

F. A. WILLIAMSON-NOBLE.

(3) **Fradkine, Jacques.—*A case of binocular cataract caused by lightning. A study in pathogenesis.* (*Un cas de cataracte binoculaire produite par la foudre. Étude pathogénique.*) *La Clin. Ophtal.*, June, 1925.**

(3) **Fradkine** reports in detail the occurrence of binocular cataract in a boy, aged 13 years, caused by lightning stroke. He was first seen by Fradkine twenty-two days after the event and was then found to have a very violent irido-cyclitis in the left eye and binocular cataract. After eight months the irido-cyclitis had disappeared and had left no trace, but the cataracts were exactly as before. Fradkine's main object in recording the case is to study the pathogenesis. This study is preceded by a dissertation on the electrical resistance of the human body and enters, as the author remarks, into *le domaine psychobiologique*.

ERNEST THOMSON.

(4) **Knapp, Dr. Arnold (New York).—Late results of intracapsular extraction of cataract.** *Arch. of Ophthal.*, May, 1926

(4) **Knapp** has followed up, as far as possible 200 successive intracapsular cataract extractions performed by him between the years 1910 and 1919. The operation in all cases consisted of preliminary subluxation with blunt capsule forceps (*Arch. of Ophthal.*, 1915 and 1921). Eighty-five of these cases have been traced with the following results: 16 died, and in these vision at the last examination, or from report of relatives, had remained good. In 57 cases vision had remained as good as after operation or had improved; in five of these there had been vitreous loss. In these 57 cases, on slit-lamp examination, the vitreous presented in the pupil as a membrane bulged forward or more or less flat. In some cases it was intact and covered with a number of fine brown dots, or there were one or more irregular holes through which vitreous presented. This membrane was absent in cases of vitreous loss. There is no question that the vitreous is much more free from opacities in these cases than in the capsulotomy ones. With regard to complications glaucoma developed in one case six years after operation in association with heterochromic iritis, but its association with the method of operation was not definite. In two cases of chronic glaucoma and cataract the glaucoma was relieved after intracapsular extraction; in a third case, however, the condition persisted and required a second operation. Detachment of the retina was not observed in a single re-examined eye. Detachment of the choroid was observed in a number of cases and remained unchanged for a long time, often several months. With regard to inflammatory reactions the pupillary margin became attached to the underlying hyaloid to a varying degree, with faint opacities in the hyaloid and displacement upwards of the pupil (3 cases). In two cases the condition was more marked, the cornea becoming clouded and the periphery vascularized. The author's conclusions are: (1) if the primary result is good, excellent vision is retained and the patients have surprisingly little trouble; (2) there is no degeneration of the vitreous; (3) there is remarkable freedom from glaucoma, retinal detachment, and from the sequelae of irido-cyclitis except for the serious, but fortunately rare complication of sclerosis of the cornea.

F. A. WILLIAMSON-NOBLE.

(5) **Cruickshank, Major M. M. (Rawalpindi).—Iritis following cataract extraction.** *Indian Med. Gaz.*, October, 1926.

(5) During Dr. Holland's annual six-weeks' clinic at Shikarpur, Northern India, at the beginning of 1926, **Cruickshank** examined 1,260 eyes at periods ranging from four to ten days

after cataract extraction, for evidences of lower grade inflammations that might be classed as iritis. The object was to determine the influence of lens matter or blood left in the eye. The great bulk of the extractions had been intracapsular, but the exact figures are not given.

Eighty-two eyes were found free from keratic precipitates and from tenderness on pressure, but with haziness and indistinctness of the iris pattern, with or without fibrinous exudate.

Seventy-five of the eighty-two inflammations followed intracapsular operations. Seventeen of these were attributed to infection of some kind, since no obvious local cause could be found. Eight cases, with clouding of the cornea, were attributed to entry of perchloride solution into the eye during operation.

Sixteen inflammations were associated with "retained capsule or cortex," and were considered to be largely due to this retention. Nine others followed rupture of the lens capsule during expression, the capsule being usually successfully extracted. The lower rate of iritis in these cases in which the ruptured capsule was removed, led Major Cruickshank to a strange conclusion: "the figures therefore would point to capsule rather than to cortical matter being the irritant"! He found that "both after the intracapsular and the capsulotomy operations, where capsular remains were left behind, the percentage of iritis was equal in both cases, approximately 27 per cent." (In obtaining this ratio for the capsulotomy operations, the whole of these operations that were complicated by iritis were for some unexplained reason not included; though naturally in all of them capsule was left in the eye.) Fifteen cases of iritis following removal of the lens in its capsule, in addition to the above, were associated with the presence of blood in the anterior chamber, and this was considered to be partly the cause of inflammation. The incidence of iritis after the intracapsular operation was 6.2 per cent., whereas after the capsulotomy operation it was 19.4 per cent.

Major Cruickshank finds that "in the majority of cases the iritis, which one sees from the fourth to the tenth day after extraction of the lens, is due to the retention of foreign material such as blood, capsule, cortex, or to traces in the anterior chamber of strong antiseptic fluids, used in cleansing the conjunctival sac." This conclusion may be very comforting to intracapsular operators. But it entirely fails to reach the average ophthalmic surgeon, working under more settled conditions, who finds that when every possible care is taken to exclude external organisms, there is little reason to fear blood or cortex left in the eye. It seems hardly necessary to refer to unimpacted lens capsule as a cause of early iritis. It has long been accepted that after extraction in the capsule the eyes are, generally speaking, much freer from

evidences of moderate early reaction than after the old-fashioned operation, the difference being due to irritation from cortical remains in the latter operation. But this transient reaction, though it may include a temporarily muddy iris, with an unclean pupil and coloboma, is quite distinct from the much more prolonged trouble that is commonly recognized as iritis. Unfortunately, the periods of observation in Major Cruickshank's cases were too brief to be of value for the purpose for which they have been used, though the figures have much interest in a more restricted application.

H. HERBERT.

(6) **Ferrer, Dr. H. (Havana). — Pre-operative tonometry in cataract extraction.** *Revista de Medicina y Cirurgia de la Habana*, Vol. XXI, p. 251, 1926.

(6) **Ferrer,** in a paper read before the Science Academy of Havana in May, 1926, strongly recommends the routine use of the tonometer before operating for cataract. He considers that the tonometer gives valuable information as to how the lens will behave when an attempt is made to extract it. His measurements were all made with the MacLean tonometer and the figures given in his conclusions apply to that instrument. They are as follow: (1) "the intraocular pressure of every cataract patient should be investigated; (2) the eye is in the best condition for extraction when the pressure lies between 23 and 33; (3) if the pressure is below 23, previous use of atropine is to be recommended, and, if over 38, then pilocarpine should be employed. If the pilocarpine fails to reduce the pressure then a preliminary iridectomy should be performed; (4) post-operative use of atropine is indicated if the pressure is below 28, if the pressure is between 28 and 35 atropine should be used with caution, and never if the pressure is above 35." He also points out the inadvisability of simple extraction when the pressure inclines to the higher figure of safety.

E.E.H.

(7) **Coppez, H. (Brussels).—On the operation for cataract. (Sur l'opération de la cataracte.)** *La Clin. Ophtal.*, June, 1926.

(7) **Coppez** reviews the individual steps of the cataract operation as it is performed to-day by various operators and gives his opinions on some of these procedures. These must be abbreviated for reasons of space. With regard to anaesthesia the majority of authors, Coppez himself included, prefer cocaine in various strengths and spread over various periods. Neither retrobulbar nor subconjunctival injections find favour with the author:

on the other hand, he considers injections to paralyze the eyelids indispensable, and they should be carried out prior to the conjunctivo-corneal anaesthesia. Coppez prefers the supine posture but does not hesitate to operate on the sitting patient if obese or asthmatic. He prefers artificial illumination under intense light which causes pupil contraction. Coming to the actual operation the author discusses fixation rather fully. He makes (when using the von Graefe knife) a conjunctival flap after the method of van Lint, but considers a corneal suture to be a useless and dangerous complication. He gives the technique for the use of the keratome in cataract extraction: this does not seem to differ much from common usage. The section should extend half round the cornea. What Coppez has to say about iridectomy is interesting. Thirty years ago Snellen had said to him, "so long as you are under fifty you will do extraction without iridectomy; after fifty you will do iridectomy." However, the master's prophesy has not been fulfilled, for Coppez only does an iridectomy when he must, and he is over fifty, though how much over that age he does not inform his readers. The various methods of opening the capsule and expulsion of the lens do not seem to call for special remark but the method of dressing is interesting and may be given textually. "I then instil five to ten drops of oily solution of pilocarpine 2 per cent., so as to plunge the eye in a bath of pilocarpine. There are several advantages in this: the oil efficiently protects the cocainized cornea from dessication, and the pupil is strongly contracted in a few minutes, thus reducing to a minimum the risk of hernia of the iris. Further, since the paralysis of the lids lasts for about a couple of hours the patient is unable, when the corneal anaesthesia passes off, to exercise pressure on the eyeball. . . . In short, the immobilization of the lids and the pilocarpine bath together give assurance of a normal recovery without fear of iris prolapse." An actual dressing is not usually employed; only a Fuchs' wire guard.

Finally, Coppez is no supporter of extraction in the capsule and considers that this operation is not progressing in favour. His reasons for disliking the operation may be given. "To say nothing of the frequent operative difficulties I have noticed even in the best cases the progressive drawing up of the pupil and entanglement of the iris in the days following the operation, and without apparent reason for it. Further, the anterior layers of the vitreous may become opacified and thus bring about a secondary pseudo-cataract. Lastly, Descemet's membrane is often damaged by the passage of the lens."

ERNEST THOMSON.

(8) **Hume, Graydon (London).—The intracapsular operation for cataract extraction.** *Lancet*, October 16, 1926.

(8) **Hume's** description of the intracapsular operation practised by the brothers Green (Louis and Aaron) in San Francisco, seems to suffer from lack of detail of the operation itself, although a detailed description is given of the method of orbital anaesthesia. The operation performed is a suction one but there is considerable difficulty in following the author's meaning in the description of the use of the suction cup: "It is of great importance to emphasize here that the technique of the Drs. Green differs very considerably from that of Barraquer. In the method just described (*i.e.*, the introduction of the suction cup and the 'deft removal' of the cataract in its capsule) suction only is used to draw out the lens with its capsule, and no vibrations or trembling movements are required to rupture the zonule of Zinn." One feels that a more close description of details is badly required before the operation can be properly appreciated by ophthalmic surgeons.

ERNEST THOMSON.

(9) **Jacqueau and Bujadoux (Lyon).—Retro-ocular anaesthesia in cataract operations. (L'anaesthésie retro-oculaire dans les opérations de cataracte.)** *La Clin. Ophtal.*, March, 1926.

(9) **Jacqueau** and **Bujadoux** have developed their technique of retrobulbar anaesthesia in the cataract operation for two classes of case: (1) where one has to fear the restlessness or "indocility" of the patient; (2) in complicated cataract such as that associated with high myopia or old irido-choroiditis. There seems to be nothing very special in the technique which is essentially similar to that employed in the local anaesthesia employed in enucleation. A three centimetre needle is introduced 1.5 cm. to 2 cm. at the lower and outer part of the orbit, avoiding the periosteum. The anaesthetic may be whatever the operator prefers. The authors employ 4 per cent. scurocaine. The conjunctiva is anaesthetized in the usual way. Many French writers have a power of graphic description which is best appreciated in the original language, yet, although "scenes" in the operating theatre are probably less frequent in Britain than in France owing to temperamental differences between the peoples, the reviewer would like to attempt to convey the authors' description of a type of case which we have all come across now and then.

". . . . and when we speak of indocility we are not merely thinking of those agitated people who have passed a sleepless night and arrive in the operating room on the defensive, eyelids screwed together, starting wildly at the slightest touch, wailing and gesticulating as they lie on the table. We are thinking also

of the 'determinedly resigned' (*résignés volontaires*) type. They are most often men, men of intellect, men of affairs who look to the recovery of their professional position. They lie down apparently quite calm: it is a deceptive calm. The held breath, the monosyllabic reply, the slow response to instructions, the frowning brow, and the tremor of the eyelids, the tension of every muscle in the body, all show the power of the will contending with fear. These are the people who never relax until the operation is over: then a slow and deep inspiration relieves their feelings and shows, often, the danger from which the operator has escaped. And it is in fact these very patients, with all their apparent calmness, who will, when it is least expected, expel the vitreous without any contraction of the eyelids, owing to a condition of internal pressure which is apparently connected with turgidity of the choroidal vessels. . . . On one occasion we felt it coming, stopped the operation and made a retrobulbar injection which was entirely successful in producing absolute relaxation."

ERNEST THOMSON.

(10) **Spilios, Charamis (Athens).—The most certain and effective procedure in the surgical treatment of cataract.** (**Le procédé chirurgical le plus sûr et efficace dans le traitement chirurgical de la cataracte.**) *Arch. d'Ophtal.*, July, 1926.

(10) This paper contains a valuable statistical record of **Spilios'** personal experience in the operative treatment of cataract. Analysis of his results has led him to a definite opinion as to the relative value of certain methods of operating.

His figures pertain to a period of twenty years during which 66,945 patients came to his clinics in Athens and the Piraeus. Of this total 2,375 cases of cataract underwent operation.

Three methods of operating were adopted: extraction without iridectomy; extraction combined with iridectomy; extraction after preliminary iridectomy.

The author's figures are noteworthy. Extraction without iridectomy was successful in 93 per cent.; extraction combined with iridectomy in 97 per cent.; extraction after preliminary iridectomy in (practically) 100 per cent. Of a total of 321 extractions by this last method 320 were "absolutely successful"; the one failure was due to "escape of vitreous followed by cyclitis."

No particulars are given of the age or other conditions of the patients, but in view of these striking results it is not surprising that the author is a convinced advocate of extraction after preliminary, or as he terms it, "preparatory" iridectomy.

J. B. LAWFORD.

(11) **Sava-Goïou (Jassy, Roumania).—A new method of capsulectomy in the operation of cataract extraction. (Un nouveau procédé de capsulectomie dans l'opération de la cataracte.)** *Ann. d'Ocul.*, Vol. CLXII, p. 786, 1925.

(11) **Sava-Goïou** describes his operation as follows: "after full dilatation of the pupil by means of atropine the previous day a disc of anterior capsule is cut with a cystotome. The instrument is inserted in the usual manner, applied to the lens at its most inferior part (6 o'clock) close to the pupil margin, and made to describe a circle, either in one or two movements. Kalt's forceps is inserted and the anterior capsule removed." By this means it is claimed that the anterior capsule is removed nearly to the equator of the lens, that the lens is delivered almost complete with a minimal retention of soft lens substance. In the course of several years four hundred extractions have been performed by this means without the development of a single secondary cataract.

HUMPHREY NEAME.

(12) **Green, John (St. Louis).—Safeguards in cataract expression.** *Jl. Amer. Med. Assoc.*, August 7, 1926.

(12) The term cataract expression, **Green** explains, denotes the removal of the lens by pressure after tearing the capsule. He is fully convinced of the supreme value of preliminary iridectomy. Besides surface anaesthesia by the instillation of 5 per cent. cocaine solution he gives a subconjunctival injection of three or four drops of novocaine 2 per cent.

The expression is carried out a month or so later. He fashions a large thick conjunctival flap before making his section and inserts a sclero-conjunctival suture through episcleral tissue and conjunctiva in order to close the wound after the operation, according to the method of Verhoeff. He uses capsule forceps to open the capsule. The lens is removed in the ordinary way. Two conjunctival sutures are inserted after the sclero-conjunctival suture has been tied.

His vitreous loss is 13 per cent. in 76 consecutive operations. He had no infections, in spite of the silk suture being left in contact with the lashes and eyebrows during the operation.

A. F. MACCALLAN.

(13) **Marchetti, Alaimo (Girgenti, Sicily).—The abolition of the speculum in cataract operation. (Per l'abolizione del blefarostato nella operazione di cataratta.)** *Atti del Cong. d'Oftal.*, Rome, 1925.

(13) **Marchetti** draws attention to an article which he wrote in 1902 pointing out the dangers which may arise from the use of

the speculum in cataract operations. He uses instead, to hold the eye open, loops of thread which he inserts in the lids near the edges. The loops take hold of a centimetre of skin and are 10 cm. long. The assistant who holds them has his hands well away from the field of operation; he can release them and allow the lids to close the moment this is necessary.

ARTHUR D. GRIFFITH.

II.—DISEASE OF CONJUNCTIVA

(1) **Cange, A., and Duboucher, H. (Algiers).—An undescribed form of fungoid tarso-conjunctivitis. (Une forme non décrite de tarso-conjonctivite végétante.)** *Arch. d'Ophtal.*, October, 1925.

(1) In this paper **Cange** and **Duboucher** describe clinically and histologically a case of tarso-conjunctivitis which in their opinion cannot be classed with any of the known varieties of conjunctival disease. Their studies have been limited to one example; the reasons which lead them to label this an "undescribed" form are given at some length. Illustrations of the clinical appearances and of the microscopic characters of the disease are added and the following *résumé* completes a long paper.

Clinically the disease is characterized by: (*a*) the development on the tarsal conjunctiva of vegetations which though unequal and irregular are always voluminous; they are not confluent, are sessile at their bases and often flat at their summits, have a bright red colour and are fibrous in consistence; (*b*) large folds or cushions which, emerging from the conjunctival culs-de-sac, lie between the lids and the globe and spread in front of the ocular conjunctiva and the cornea; they are movable and imbricated; (c) diffuse and irregular infiltration of the tarsus, of a wooden hardness, and, by reason of the great thickening, an appearance of massive hypertrophy of the palpebral region; (*d*) the co-existence of chronic polyadenopathy in the area of efferent lymphatics. To this tetrad of fundamental symptoms must be added, the integrity of the cornea, the absence of local inflammatory phenomena, the slow evolution and the interminable duration of the disorder, the preservation of good health, and the absence of any known diathesis or antecedent malady.

Histologically the chief lesions are: (*a*) a diffuse and chronic inflammation of the subconjunctival, tarsal and epitarsal tissues which are abundantly infiltrated with lymphoplasmocytes but devoid of eosinophiles. In the infiltrated area are found basophile

collagen fibres which grow inordinately, lose their basophile characters and ultimately become transformed into a vitreous-like substance. These fibres are subsequently attacked by numerous plasmodia which become closely attached, and seem to be the agents of an important morphological change which leads to the formation of a vitreous substance with spaces in which circulates fibrinous lymph poor in plasmocytes; (*b*) the conjunctival mucous membrane is usually unaffected in its whole thickness, but if sometimes its stroma becomes infiltrated by cells from the deeper tissues its epithelial layers are but little altered; (*c*) such thickening as occurs in the conjunctival epithelium is only the result of the abnormal friction of this structure when pushed forward by the underlying inflammatory material.

J. B. LAWFORD.

(2) **Rohrschneider, Wilhelm.—Swimming-bath conjunctivitis and its endemic appearance in Berlin from 1919 to 1925. (Die Schwimmbadconjunktivitis und ihr endemisches Auftreten in Berlin von 1919 bis 1925.)** *Klin. Monatsbl. f. Augenheilk.*, May, 1926.

(2) Berlin has been visited by several epidemics of swimming-bath conjunctivitis. During the period under review no fewer than 416 cases were notified to the authorities. The fact that in Berlin instruction in swimming is now obligatory in all schools renders the study of the disease rather a pressing matter. The symptomatology was first accurately described by Fehr in 1900, and this author definitely distinguished it from trachoma with which it has certain analogies.

Rohrschneider points out that the clinical picture of an early well-developed case is so typical that it is unnecessary to ask the patient whether he has recently patronised a swimming-bath. External inspection of the patient, who is generally young, shows a definite ptosis and only a slight secretion from the eye. Discomfort is slight and there is no photophobia. It is astonishing how slight are the subjective symptoms when closer inspection reveals massive swelling of the conjunctiva, not only the palpebral but also the bulbar and the plica semilunaris, which have a greyish-red oedematous appearance. The follicles of the tarsal conjunctiva and cul-de-sac are clearly seen shining through the conjunctival epithelium. They are mostly small and rarely confluent. Apparently the cornea is unaffected but examination with the slit-lamp, after staining with fluorescein, shows fine epithelial defects. The clinical picture has considerable similarity to that of trachoma with which indeed swimming-bath conjunctivitis has frequently been confused.

Epithelial inclusions were found in this disease by Huntemüller and Paderstein, and it must be classed as an "inclusion conjunctivitis." The chief point of distinction from trachoma is the complete recovery; there is never any cicatricial network left in the conjunctiva and pannus is unknown. Here again we see the relationship with inclusion conjunctivitis of the ophthalmia neonatorum group described by Lindner as of genital origin. The inclusion conjunctivitis of the new-born is sharply separated from swimming-bath conjunctivitis by the abundant secretion of the former being absent in the latter. When the disease attacks adults the similarity of swimming-bath conjunctivitis is much greater. The patients described by Lindner who closely resembled cases of inclusion ophthalmia neonatorum showed "typical follicular trachoma" even in some cases with pannus, but in every instance recovery was complete with no formation of scar tissue.

Patients suffering from swimming-bath conjunctivitis are generally young, the majority of the cases being between ten and twenty years. Females are less liable to the disease, but in all probability because they do not dive so much or swim under water to the same extent. The incubation time is from one to two weeks, another point of similarity with the inclusion blenorrhoea of adults. Not infrequently one eye is affected before the other. The disease may last for several weeks, on an average for two months, but occasionally much longer. Cell inclusions in swimming-bath conjunctivitis seem to be less resistant than in ophthalmia and for this reason are not so frequently discovered. The following table gives the percentages in which inclusions are found in various conditions:

Swimming-bath conjunctivitis	33.75
Trachoma	44.75
Suspected trachoma	14.78
Ophthalmia neonatorum	34.48
Follicular catarrh	3.58
Other forms of conjunctivitis	0.0

The author has found cell inclusions in 68 per cent. of his last 22 cases and he is of the opinion that at some time in the course of the disease they would invariably be found. All depends upon taking the material at the correct moment.

Treatment is of the routine type. For the first eight to ten days the lids are swabbed with a 1 per cent. solution of silver nitrate. Then this treatment is omitted on alternate days and the lids touched with the alum crayon. Copper sulphate is never employed nor is it ever desirable to express the follicles.

It is probable that the virus is contained in small masses of mucus floating in the water. Considerable success has been

achieved in the prevention of the disease by disinfecting the water with chlorine, but this method, successful in Berlin, was a failure in Magdeburg.

The author discusses the question of the genital origin of the disease, pointing out that cell inclusion urethritis has been shown by Lindner to produce a pathological picture indistinguishable from trachoma. It seems highly probable that swimming-bath conjunctivitis is closely connected with disease of the genital organs, and is due to the unpleasant habits of some of those who frequent public baths.

T. HARRISON BUTLER.

(3) **Sandmann.—Swimming-bath conjunctivitis in Magdeburg. (Die Schwimmbadconjunktivitis in Magdeburg.)** *Klin. Monatsbl. f. Augenheilk.*, May, 1926.

(3) This paper following the same lines as that by Rohrschneider and **Sandmann** comes to the same conclusions. He is emphatic that swimming-bath conjunctivitis is a cell inclusion disease.

T. HARRISON BUTLER.

(4) **Offret (Paris).—A new treatment of gonococcal ophthalmia of the new-born: the local employment of anti-gonococcal serum. (Nouveau traitement de l'ophtalmie gonococcique du nouveau-né: emploi local du sérum anti-gonococcique.)** *La Clin. Ophtal.*, November, 1925.

(4) **Offret** began to study the action of vaccine on ophthalmia of the new-born so long ago as 1914. At that time in spite of good results he could not admit that the action of vaccine in gonococcal ophthalmia could be compared with that of Roux serum in diphtheria, and he would not recommend its use as a sole treatment, *i.e.*, without the simultaneous employment of the classical treatment. But now he has had five cases treated by the local administration of the anti-gonococcic serum of Blaizot, and, so far as he is concerned, with nothing else. It is admitted that local treatment had been used before some of the cases were seen by Offret. Undoubtedly, the results are rather arresting. Case I was intense and bilateral with peripheral erosion of one cornea. Complete cure in five days. Case II, intense and bilateral. Acute stage past in twenty-four hours after commencement of treatment. Secretion persisted for eight days. Cure in ten days. Case III, medium intensity, bilateral. Infiltration of both corneae. Cure in two days. Case IV, medium intensity, unilateral. Cornea hazy. Cure in four days. Case V, slight intensity, bilateral. One eye treated with serum, the other with 25 per cent. protargol. Both eyes cured in four days. The gonococcus was identified in all five

cases. The author gives a description of the preparation of the serum which is put up in ampoule tubes (*tubes ampoules de* 10 c.c.). The serum is instilled practically continuously, that is every half-hour. No lavage is employed. The author says: "Each tube should be changed at least every twenty-four hours. In future it will be advantageous to make use of special flasks for the collyria." Apparently therefore the serum is not at present readily obtainable. One naturally looks forward to further communications on this subject with considerable interest.

ERNEST THOMSON.

(5) **Beauvieux (Bordeaux).—The prognosis of diphtheritic conjunctivitis. (Le pronostic de la conjonctivite diphtérique.)** *La Clin. Ophtal.*, September, 1925. From *La Gazette hebd. des Soc. méd. de Bordeaux*, May 31, 1925.

(5) This is a clinical article expressing **Beauvieux's** views on the subject of diphtheritic conjunctivitis. The author divides true diphtheritic conjunctivitis due to the bacillus of Loeffler into two categories, the superficial or croupous form and the interstitial or deep form. The former with good prognosis is almost always observed in non-debilitated subjects whose general condition is good, the latter with bad prognosis for the eye and even for life occurs where the resistance is feeble. The superficial form is apt to occur in association with the usual saprophytes of the conjunctival sac and may follow the conjunctivitis of measles or scarlet fever. The interstitial, deep necrosing form is essentially, in the opinion of the author, who follows Sourdille in this opinion, associated with the streptococcus. The matter may be summed up in the words of Sourdille: "The more benign cases are those where the bacillus of Loeffler is associated only with the staphylococcus. Association with the streptococcus alone or with the streptococcus and staphylococcus is usually of much greater gravity. This association acts by increasing the virulence of the Loeffler bacillus or by uniting the respective virulence of the microbes concerned, or by making a large opening for the diphtheritic infection, it hardly matters which; the demonstration of the fact itself suffices."

ERNEST THOMSON.

(6) **Spaeth, Edmund D. (Canal Zone, Panama).—Rotated Island graft operation for pterygium.** *Amer. Jl. of Ophthal.*, September, 1926.

(6) **Spaeth** has been employed since July, 1925, in the Panama Canal Zone, when he was astonished at the extent of the growth in some of the pterygium cases under his care. The ordinary operations, while quite well adapted for the cure of slight pterygia,

were not satisfactory for the extensive cases, when the growth had extended well over the pupil, dragging the conjunctiva with it and displacing the caruncle for a distance of several millimetres. The following procedure was therefore evolved. The head of the pterygium was torn from the cornea by the usual method, with a stout silk suture, the raw area being carefully curetted with a sharp spoon. The body of the pterygium could now be regarded as included within a square of conjunctiva of which one side formed a tangent to the cornea. The margins of this square were cut through with scissors, sutures being placed to unite the top left hand corner of the conjunctival wound with the top right hand corner of the square, the bottom left hand corner of the wound with the top left hand corner of the square, and so on all the way round. The effect of tying these sutures was to rotate the square through 90° so that the pterygium was pointing upwards instead of towards the cornea. A variable amount of undercutting of the conjunctival square was necessary in order to allow of its rotation without putting undue tension on the stitches. A few additional sutures were necessary to secure coaptation of the wound, but the side tangential to the cornea was purposely allowed to gape a little in order to prevent the conjunctiva growing again over the cornea. A binocular dressing was applied for seventy-two hours, after which the eyes were washed out, and a second dressing applied for a similar period. Sutures were then removed and the patient allowed to go without a dressing. Sixty cases have now been dealt with by this method with eminently satisfactory results.

F. A. WILLIAMSON-NOBLE.

III.—DISEASE OF IRIS

(1) **Fuchs, Ernst (Vienna).—On chronic infiltrating iritis. (Über chronische infiltrierende Iritis.)** *Arch. f. Ophthal.*, Bd. CXVI, H. 1, 1925.

(1) The type of iritis, of which **Fuchs** here treats, is characterized by a dense infiltration of the iris tissue with mononuclear cells. These cells are of two kinds: (*a*) lymphocytes, which are the product of proliferation of the adventitial cells of the blood-vessels and the mesenchyma cells generally; and (*b*) plasma cells, which are derived from lymphocytes. In individual cases one of these cell-types greatly predominates; the grouping of cases according to the cells does not absolutely exclude the presence of the other. The distribution of these cells varies according to the type present, in the case of the lymphocytes the infiltration is pretty

uniform, except for a few clumps which are mostly situated in the posterior layers of the iris, while the plasma cells frequently form long bands running roughly parallel to the surface of the iris or, if they are very close together, assume a pavement-like appearance, which under the microscope shows up very distinctly from the arrangement of the lymphocytes.

The stroma of the iris is not much altered by this infiltration—it may be normal, or show signs of oedema, or the chromatophores may exhibit more or less the stages of disintegration.

Extension of the infiltration into neighbouring parts may occur, but the main seat of it remains in the iris. Exudation on the free surface of the membranes is slight, being mostly confined to posterior synechiae and pupillary membranes and the characteristic precipitates on the back of the cornea.

The author analyzes his cases according to their endogenous and exogenous origin. As to the former class, he points out that there is no ascertainable determining factor of the production of lymphocytes or plasma cells, and he regards them as merely varieties of the same proliferating inflammation.

In the exogenous, or traumatic cases, the anatomical appearances are similar to those in the endogenous class, but are modified by the presence of other changes as the result of the perforating injury.

Clinically, these cases of infiltrating iritis are all characterized by a chronic course and the peculiar exudation, in the form of precipitates, on the back of the cornea, while the appearance of the iris itself is not characteristic. As regards the microscopical features of the endogenous cases, the infiltration of the iris with lymphocytes and plasma cells, its long duration, the slight alteration in the stroma of the iris, and the restriction of the inflammation mainly to the iris give the impression that they are the features of a distinctive type of iritis.

THOS. SNOWBALL.

(2) **Fuchs, Ernst (Vienna).—On lymphocytic infiltration of the choroid. (Über lymphocytäre Infiltration der Aderhaut.)** *Arch. f. Ophthal.*, Bd. CXV, 1925.

(2) **Fuchs** not infrequently found a collection of lymphocytes in an otherwise normal choroid in apparently normal eyes that had been removed from cadavera, a condition which he regards as pathological. This infiltration of small lymphocytes was situated mainly in the posterior part of the choroid, for the most part in the intervascular spaces of the great veins, though sometimes between the lamellae of the suprachoroidea or in the capillary layer. These cells are the product of proliferation of the adventitial cells of the vessels and the mesenchyma cells of the connective tissue.

This condition cannot be diagnosed during life as it causes no disturbance of vision and is not seen by the ophthalmoscope. The cause of this infiltration is not obtainable in the eye itself, which showed no changes, but is to be found in the disease from which the patients died: toxins arising in the focus of disease, circulate in the blood, and pass from the capillaries of the choroid into its tissues and stimulate the cells to the formation of lymphocytes. The choroid probably reacts with a production of these cells, in the same way as internal organs do, owing to its reticulo-endothelial structure and its rich supply of blood-vessels.

In cases of leucaemia, not included in the above series, the infiltration of the choroid showed different features: (*a*) the frequent occurrence of large lymphocytes; and (*b*) in more advanced cases a disintegration of the walls of the veins, but the mode of origin was essentially the same as in other diseases.

This reaction in the choroid may also be produced from lesions in the eye: (*a*) in the choroid, where the toxins are carried along it in the lymph stream as in miliary tuberculosis of the choroid; or (*b*) lesions in the anterior segment of the eye, *e.g.*, corneal ulcer or injury, where between the original lesion and the choroid affected there is an area free from infiltration. In this latter group the author thinks that, apart from those cases where the transmission of the toxins to the choroid is *via* the vitreous and retina, they are carried along the lymph sheaths of the veins of the ciliary body and choroid.

This infiltration may remain long after the signs of inflammation in the original focus of disease have disappeared, but it has no relation to sympathetic ophthalmitis.

A collection of lymphocytes of long standing is also seen in many cases of old retinal detachment, where the retina is separated at the ora serrata. Here the choroid is raised by traction of the retina and, the pressure being diminished, fluid and lymphocytes collect in and under the choroid.

THOS. SNOWBALL.

(3) **Rodin, Frank H. (San Francisco, California).—Treatment of irido-cyclitis by subconjunctival injections of atropine and epinephrine.** *Amer. Jl. of Ophthal.*, January, 1926.

(3) **Rodin's** method of treating acute irido-cyclitis is as follows: Instillation of 4 per cent. atropine which is repeated every half-hour. If a good dilatation is not obtained within two hours a subconjunctival injection of atropine and adrenaline is given in the following manner. The eye is cocainized and a sterile solution of one part of 2 per cent. atropine to two parts of 1:1,000 adrenaline is sucked up into the syringe. Three minims of this solution are then injected subconjunctivally about 2 mm. below the lower

border of the cornea. If posterior synechiae are localized to a particular part of the iris, the injection is made along the limbus, close to the adherent part. The eye is then covered by hot applications for half an hour. If good dilatation is obtained the patient returns home and attends daily, for investigations into the aetiology, and treatment of the cause. If good dilatation does not occur he is admitted to hospital for further treatment. In patients over 45 years, or where there is increased intraocular tension, homatropine is used at first. If this produces a further rise of tension 6 minims of adrenaline solution are injected subconjunctivally and when the tension is reduced, atropine is used. Some cases of course require paracentesis, etc. This method of injecting atropine and adrenaline has little or no effect on old adhesions, but acts very powerfully on recent ones and is effective, even where crystals of atropine fail to dilate the pupil.

F. A. WILLIAMSON-NOBLE.

IV.—MISCELLANEOUS

(1) **Woodruff, George (Joliet, Illinois).—Our knowledge of focal infections.** *Amer. Jl. of Ophthal.*, October, 1925.

(1) **Woodruff's** paper is of interest in connection with the aetiology of intraocular disease. He quotes a series of five cases. The first was a patient who had over twenty attacks of iritis in a period of fifteen years. The teeth were examined by X-rays, infected ones being removed, and he remained free from further attacks over a period of seven years. He also had diabetes and the author is inclined to attribute this disease to the presence of the dental infection. The second case was one of acute macular choroido-retinitis which cleared up after removal of tonsils infected with streptococci. The vision when first seen was 2/200 and eventually became 20/15. The third case was one of a copious vitreous haemorrhage which cleared up under local measures and the removal of dental infection, so that the vision seven and a half months later was 6/10. No recurrence had been noted up to date. The fourth case was one of left abducens paralysis and acute nephritis following acute tonsillitis and recovery after improvement of the latter, while the fifth one was a recurrent iritis which yielded to the removal of infection about the root of a tooth. The author quotes a report by Brown and Irons on the aetiology of 100 cases of iritis. Of these 23 were syphilitic and gonococcal, 8 tuberculous, 18 due to dental infection, 16 to tonsillar infection, 3 to sinus disease, 3 to non-venereal genito-urinary infection, 2 to other infections, and 17 to combined infections.

F. A. WILLIAMSON-NOBLE.

(2) **Peacock, P. R.—The action of light on cod-liver oil.** *Lancet*, August 14, 1926.

(2) Ophthalmologists make such free use of cod-liver oil in their practice that a short abstract of the investigation carried out by **Peacock** on the behaviour of cod-liver oil under ultra-violet illumination may not be out of place. Peacock (who is Vaughan Morgan Scholar and Margaret Butcher Scholar at the Middlesex Hospital) noticed, while carrying out an investigation of oils and fats, that cod-liver oil was markedly fluorescent under the action of ultra-violet light, but lost this characteristic with continued exposure to sunlight. The question suggested itself "has the phenomenon of delumination any relation to the vitamine content of the oil?" We need not describe the experiments and control experiments which were then carried out to determine the action of sunlight, and even of any source of white light of sufficient intensity, on the vitamine content. It was found that Vitamine A. was destroyed, in association with though not *pari passu* with, loss of fluorescence (the process being called by the author "delumination") and that, while fluorescence could be partly restored by keeping the oil in the dark the Vitamine A. could not be recovered. With regard to Vitamine D., experiments made in the laboratory of Professor C. J. Martin showed that there seemed to be no association between fluorescence and the anti-rachitic value of various oils and extracts. There was no evidence to suggest destruction of the anti-rachitic vitamine in cod-liver oil by sunlight.

The importance of this investigation is emphasized in the editorial columns of the *Lancet*.

ERNEST THOMSON.

(3) **Zentmayer, W., M.D. (Philadelphia).—The prostate as a remote focus of infection in ocular inflammations.** *Jl. Amer. Med. Assoc.*, October 9, 1926.

(3) **Zentmayer** reports four cases of metastatic infection in the eye in order to direct attention anew to the importance of searching further than the mouth, nose, and throat for the portal of infection, and to emphasize that it is not infrequently to be found in the prostate gland. A causal relation of a focus of infection to a metastatic inflammation is not often susceptible of scientific proof, but the author believes that the evidence is sufficiently circumstantial. He quotes freely and with approval from de Schweinitz's 1924 address to the Société française d'Ophtalmologie. He concludes that the prostate may be the source of certain ocular inflammations, which are more often non-gonococcal than gonococcal; also that persistence of an inflammation after removal of the primary focus, does not prove that this was not the primary source of infection, as the resistance of the tissues may have been so

reduced by this inflammation as not to be able to withstand the action of organisms or toxins of much less virulence from some other part of the body. It is only when a metastatic inflammation subsides after the removal of one possible source of infection that this is proved to have been the exciter.

A. F. MACCALLAN.

BOOK NOTICES

An Introduction to the Theory of Perception. By SIR JOHN HERBERT PARSONS, C.B.E., D.Sc., F.R.C.S., F.R.S. Cambridge: University Press. 1927. Pp. viii + 254. Price 18s. net.

It is widely recognized that much of the progress in our knowledge of instinctive behaviour, sensation, and perception is attributable to the biological, physiological, psychological, and clinical researches of Lloyd Morgan, Sherrington, Rivers, and Head in Great Britain. To yet another of our fellow-countrymen—this time an ophthalmologist—we are indebted for attempting "to gather together," as he puts it, "some prolegomena to a treatise on perception and at the same time to formulate a working hypothesis."

Sir John Parsons has written an invaluable book. He has brought together all the relevant portions of the above-mentioned researches, together with those of Magnus, Piéron, Allen, etc.; he has described the most recent psychological views advanced by G. E. Müller, and by Wertheimer, and others of the *Gestalt* school; he has borrowed freely from the writings especially of Kappers on the comparative vertebrate anatomy of the nervous and sensory systems—in his very proper conviction that "psychology, *as a science*, can only be developed upon a sound biological basis"; and he has endeavoured to place our ideas of the process of perception on a scientific footing.

Sir John accepts Head's hypothesis of a dual sensory mechanism; but in place of "protopathic," he prefers to substitute the term "dyscritic." In addition to "dyscritic" and "epicritic," he introduces the term "syncritic" to denote those higher nervous integrations which may "become manifest in consciousness as conceptual thought." He believes that sensation is purely dyscritic in all vertebrates below the amphibia and probably in most of the amphibia, that is to say, that sensation is primitively characterized by an "all-or-none" character, by absence of gradation, crudeness of localization, vague diffuseness, and by a strong charge of affective tone. And he maintains that this view receives powerful support from the anatomical evidence which he is able to bring forward so interestingly and in such detail.

Throughout the book stress is laid on the play of what the author calls "the apocritic principle"—the processes of differentiation, segregation, and integration of sensations (or "recepts" as he preferably terms them) in the genesis of perception. He also insists throughout on the importance of what he terms "the backstroke influence of the higher centres" on the primordial functions of the lower nervous levels. "We are conscious only of the final products of the nervous impulses which traverse long and complicated paths . . . ; and it is only by the most searching observation, experimentation, and analysis that we gain the merest inkling of what goes on in the formative zone which underlies the final finishing shop, and which holds the secrets of earlier evolutionary stages." (The expression "formative" zone, adopted from Müller, corresponds broadly to Head's "schemata.")

For the ophthalmologist special interest attaches to the author's development of his view, originally enunciated in his Bowman Lecture of 1925, that scotopic (rod) vision exemplifies the dyscritic (protopathic), while photopic (cone) vision exemplifies the epicritic system of sensibility. True, the former does not appear to show the "all-or-none" reaction, nor does it initiate a mass reflex. But these, the author suggests, may well have existed in its more primitive manifestation. Indeed, Sir John would be the first to realize the serious difficulties, as well as the almost irresistible attractiveness, of his hypothesis. He admits that the dyscritic retinal mechanism responds in man as if it were epicritic when it is subjected to sufficiently strong stimulation, and that it has become endowed in man with some gradability and with high adaptability. But it is somewhat surprising, in the light of Head and Rivers's work, to read the statement (which, however, may well be true) that "adaptation must be considered a feature of primitive sensation." And he goes on, strangely enough, to say: "It is *a priori* more probable that it (adaptation) should remain always more attached to the diffuse dyscritic sensation, thus underlying *all* the responses of the given sense, than to the epicritic sensation, which in the cases of touch, temperature, and vision is punctate in character."

To the reviewer the whole problem of adaptation (and also of its relation to induction) seems to need closer consideration than it receives here, and he hopes that in preparing a future edition of this book, Sir John Parsons will give it his fuller attention. Frank Allen's striking work on the effects of so-called "fatigue" with spectral colours upon retinal sensitivity, etc., will be found on the whole lucidly described in fair detail; but in the reviewer's opinion it needs confirmation before it can be confidently accepted, as it has been by Sir John Parsons.

But these and other doubts and difficulties enhance rather than detract from the value of such a monumental work as this. Hardly

any other man could have brought the necessary breadth of reading and depth of thought to bear on so difficult a subject. He has clearly succeeded in revealing the essential nature and structure of perception. Explicitly or implicitly, he has indicated the respective limitations of the anatomical, physiological, and psychological approaches to the problem. And, in so doing, he has demonstrated the narrow-minded fallacies and absurdities that must result from the investigator's imperfect knowledge of, and training in, any one of these three methods of approach.

C. S. MYERS.

Tuberculous Diseases of the Eye. (Die tuberkulösen Erkrankungen des Auges.) By BERGMEISTER DR. RUDOLPH. Pp. 143. Berlin: S. Karger. 1927.

This is a clearly written book, giving a fairly complete picture of the various tuberculous diseases of the eye. In the introduction the author remarks upon the undoubted increase of tuberculosis since 1918 in Vienna. This is probably one of the results of the war and after-war privations, and its effect in different countries is variable. In this country there has not been a definite increase in tuberculosis.

The scheme of the book is first to discuss the relationship between general tuberculosis and that of the eye. Then follows a description of the disease as it affects the different parts: conjunctiva, lacrymal gland and sac, phlyctenular and epibulbar tuberculomas, affections of the cornea, with sclerosing keratitis and scleritis. Then comes a description of uveal disease and the relationship between retinal and optic nerve disease. The final chapters are devoted to a discussion on syphilis and tuberculosis, and to a review of modern therapeutic measures. In the chapter on the cornea he describes a form of corneal necrosis in lupus in which a necrosis of the central portion of the cornea took place, in the form of a large ulcer with clean-cut edges, which slowly deepened and eventually perforated with prolapse of the iris, the whole course taking about a year.

In the chapter on choroidal tubercle he describes pigmentary changes surrounding tuberculous masses occurring as the result of local reaction after tuberculin injections, and he ascribes some cases at least of shrinking of the sclera in tuberculous scleritis as due to the same cause, *e.g.*, excessive local reaction following tuberculin injection.

Altogether the book is a careful presentation of the facts. It is well arranged and contains evidence of much thought and painstaking observation. It is based on a large experience and will well repay study by anyone dealing with tuberculous disease of the eye.

CORRESPONDENCE

OCULAR PRESSURES

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—Mr. Kerry, in his letter on this subject in the last issue of the *Brit. Jl. of Ophthal.*, raises the question of the mean arterial pressure in the eye. He objects to the formula: systolic+diastolic/2 which I employed, and suggests alternatively the estimate of Donders: systolic+2 diastolic/3. He says that a glance at a sphygmographic tracing shows that my formula cannot be accurate. The formula was chosen deliberately, and I do not think that a sphygmographic tracing can be legitimately compared with the variation in the pulse pressure in the eye. In the former the systolic crest is undoubtedly accentuated as it travels along large arteries, as the brachial, partly because of the transference of the kinetic energy of a fluid in rapid motion into stress when the flow meets with resistance, partly because of the formation of breakers in the transmission of the pulse wave, and partly from instrumental inertia. In the eye, the pressure of the ocular contents enclosed within the poorly distensible sclerotic damps down this crest. Donders's estimate will probably approximate the conditions in the brachial artery; but one is not justified in applying evidence obtained here to the specialized conditions in the eye. From direct observation of the systolic pressure and of the diastolic, and of the point where the blood column was seen to pulsate in the micropipette at what appeared to be a mean value in my experiments, I consider my estimate a much closer approximation to the truth than that of Donders.

Mr. Kerry further suggests that the pressure in the vitreous should be measured manometrically, and its relation compared with the pressures in the other parts of the eye. I would refer him to the work of Monnik, Priestley Smith, Adamük, Schöler, v. Schultén, Leber, Troncoso, Höltzke, Bödeker, Bellarminoff, Hamburger, Samojloff, and several others. The point at issue is dealt with in my monograph "The Intra-ocular Fluids," 1927, where references to the literature will be found.

I am, etc.,

W. S. DUKE-ELDER.

LONDON, W.
March, 1927.

BARRAQUER'S OPERATION FOR CATARACT

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—Major Wright, Professor of Ophthalmology at Madras, writes an article in the *Brit. Jl. of Ophthal.* for February, 1925, based on a personal experience of 250 cases by Barraquer's method. It would be difficult to say what his object was in writing this paper, for he winds it up by condemning the operation and at the same time by saying that it is the best of the intracapsular operations. He gives no reason for the latter statement, nor does he say if he, himself, has had any experience of the intracapsular method by which more than 21,000 operations are done annually in the Punjab and Trans-Indus territory, out of the 36,000 officially recorded for the Indian Empire; though this territory has a population of 30 millions only as compared with the 320 millions of the Indian Empire, and though cataract is as prevalent in the other provinces as in the Punjab. The case for or against the intracapsular method of operation for cataract must depend on practical efficiency; not on any "tradition of the elders," nor on any argument that a thing should be so and therefore it is so.

Major Wright states that an escape of vitreous, or a drawn-up pupil means a lost eye. It has been demonstrated repeatedly that this is not the fact. Last winter, for example, I saw a man on whom I had operated for cataract in 1915. He had a badly drawn-up pupil—he had had escape of viterous—he is on the border of 90 years of age; he was until quite recently a member of the Punjab Legislative Council (Khan Bahadur Yusuf Shah of Amritsar), and is still an active politician, with only one eye. When I last saw him, January, 1926, his room was littered with the daily papers, and I asked him how he could see. He told me that he read all the papers himself and that he could see to thread a needle. I could quote any number of cases of a similar kind. A drawn-up pupil is put right very easily and safely; there is neither ease nor safety in putting right an after-cataract. But if Major Wright expects us to believe that he can needle an after-cataract efficiently without tearing up the hyaloid, he assumes our faculty of belief to be strong indeed.

In the paper under consideration, Major Wright does not give us a single fact of those 250 cases on which he bases his condemnation beyond these :—that he had loss of vitreous in 23 cases; that in 201 cases vision was 6/36ths and better; in 22 cases vision ranged from 6/36ths to 2/60ths; and in 20 from 2/60ths to hand movements; that there were six failures and one not examined. What information can such a crude statement convey to us? How many were 6/6ths, 6/9ths, and so on? We might have expected these

details from one who had told us, punctiliously, how carefully records are made in Madras.

But Major Wright does not tell us: (1) the size of the incision he made; (2) in how many cases lenses were left in the eye; (3) how many capsules burst; (4) how often the instrument lost its grip; (5) how often the instrument sucked up the vitreous into its concealed machine chamber (the instrument works at a vacuum of 70 centimetres of mercury); (6) how often he had to finish by other means the operation begun with this instrument, and by what other means; (7) how often he caught up the iris with the instrument; (8) what were the after-complications.

I submit that the above is the class of information that your readers have the right to expect before deciding on this issue. Instead of supplying evidence on which to base judgment, Major Wright asks them to take him on trust, and to condemn, as he does, both Barraquer's operation and all other intracapsular operations. It is to be inferred from his article that he cannot do Barraquer's operation satisfactorily. Nevertheless, we cannot get away from the fact that Barraquer himself can do the operation well, and that he gets good results. Results in cataract are determined on the operating table.

Major Wright goes on to say that nothing will decide the issue except by following up the results. Yet he is satisfied with *one* year. He slurs over the fact that Colonel A. E. J. Lister, I.M.S., Dr. Arnold Knapp, and myself have followed up the results in ample numbers, and over periods ranging from *one* to *fifteen* years.

Major Wright then falls back upon what we may call "the tradition of the Elders," and this he uses in a manner more becoming to a priest of a temple of ophthalmology than to a professor of a modern scientific school. If he were situated ten or fifteen hundred miles further north, in the Central Punjab, he would soon recognize the cogency of the argument I have advanced. For his capsulotomy school would disappear just as that " tradition of the Elders" disappeared, though it held out to the end. His article seems to me to be, so to speak, but a rear-guard action of the capsulotomy school.

Yours truly,

HENRY SMITH,
Lt.-Col., I.M.S., retired.

CATARACT

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—In addition to the authorities cited by the Editor with reference to the use of the word καταράκτης in the sense of an obstruction, it may be of interest to note that the word rendered

"windows"—in the margin "floodgates," in the story of the flood —Genesis, Ch. 7, v. 11, is in the Septuagint *καταράκται* "the windows or flood-gates of heaven were opened." Clearly in this instance the word cataract is used, not for the water which flowed, but for the obstruction the removal of which allowed the water to flow.

Yours truly,

PERCY FLEMMING.

The relevant portion of the sentence in question is as follows :—

και οἱ καταρράκται τοῦ οὐρανοῦ ἠνεώχθησαν.

The Hebrew equivalent is "areboth hasamīm." "Arebah" derived from "arab," to knot or weave means a lattice, hence a window, Ecclesiastes, 12, 3; a dove house, Isaiah, 68; a chimney, Hosea, 13, 3; all of which were closed in with lattice work; hence "areboth hasamīm," "the windows or flood-gates of heaven," which are opened when it rains, Genesis 7, 11; 8, 2; 2 Kings, 7,.19; Isaiah 24, 18; Malachi, 3, 10.—EDITORS.

NOTES

The Association of Dispensing Opticians

IT will be recalled that there appeared recently in these columns an announcement of the inauguration of an Association of Dispensing Opticians, the membership of which is confined to those opticians who devote themselves exclusively to dispensing the prescriptions of ophthalmic surgeons. One of the objects of this Association is to perpetuate and to encourage this spirit of craftsmanship, and in pursuance of this object, what is believed to be a unique competition has recently been held under the auspices of the Association. The craftsmen members were invited to submit for examination hand-made spectacles made entirely by themselves in one of three media: tortoiseshell, gold, and steel, prizes being offered for the three best in each of the three sections. A large number of entries was received; the work was of remarkably high standard, and very effectively refutes the contention that modern workmanship is inferior. It would be difficult to find more perfect specimens of the spectacle-maker's art than the winning entries in this competition.

The prize-winning frames were exhibited at the office of the Association, 439-441, Oxford Street, W.1., on March 7, 8, and 9.

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Appointment

DR. KENNETH REED HILL has been appointed Honorary Ophthalmic Surgeon to the Kent County Ophthalmic Hospital, Maidstone.

Opticians Bill

WE understand that the Ministry of Health is about to appoint a Departmental Committee to consider a draft bill prepared by the Joint Committee of Qualified Opticians, which seeks to provide for the registration of optical practitioners and to regulate the practice of sight-testing.

The draft Bill, "Optical Practitioners (Registration)," is now obtainable from H.M. Stationery Offices. We may note that in it "optometry means the practice of optometry, refraction, or sight-testing, or the examination of the human eye for the purpose of ascertaining *any departure from the normal state of vision*, measuring its functional powers and adapting or prescribing mechanical means for the aid thereof" (the italics our own). The draft further states that: "Any registered optical practitioner shall be entitled to practise optometry, and to give certificates relating to visual acuity or visual defects, which shall be recognized as admissible by any local or central authority or Government department in any part of Great Britain." We propose to discuss the subject further next month.

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Ophthalmological Society of Egypt

THE date of the Annual Meeting of the Ophthalmological Society of Egypt has been altered from March 11 to April 15, 1927.

FUTURE ARRANGEMENTS

1927

April 1.—North of England Ophthalmological Society, at Newcastle-on-Tyne.

April 28-30.—Annual Congress of the Ophthalmological Society of the United Kingdom, at Liverpool.

May 9—12.—Congress of the Société française d'Ophtalmologie, at Paris.

May 13.—Royal Society of Medicine, Section of Ophthalmology.

June 10.—Royal Society of Medicine, Section of Ophthalmology (Annual).

July 20-22.—The British Medical Association, Section of Ophthalmology, at Edinburgh.